THE ENGINEERING CONSTRUCTION WEEKLY

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April 14, 1938

Two Mississippi River Cutoffs near Greenville

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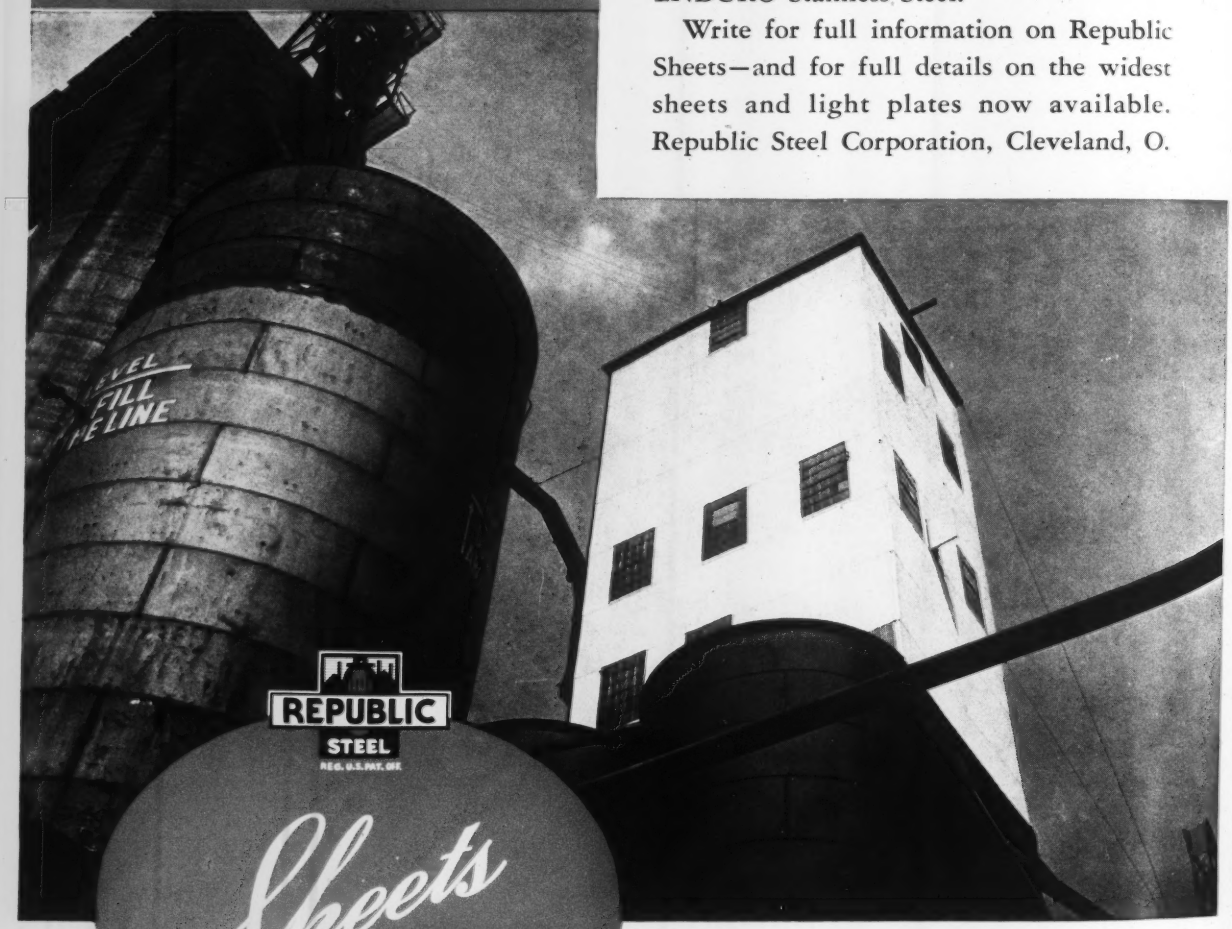

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THIS WEEK AND NEXT

WORKS for the control of floods on the lower Mississippi River built since the 1927 flood were put to a most severe test by the flood of 1937. How well they stood the test and what should be done for the future in the light of the new knowledge obtained last year is reported by the Chief of Engineers, U. S. Army.

Frequent trips by boat and foot to remote mountain stream-gaging stations are eliminated by a weir-elevation transmitting device developed at one of Denver's reservoirs.

In order not to interrupt regular service on the Montreal-Portland line of the Canadian National, two unusually heavy superstructure units were precast near an underpass site and were installed in 24 hours.

A low-cost advance for safe night driving was made last week in Michigan. A 70-mi. road is now provided with reflectors along its sides at 100-ft. intervals.

How Rhode Island provides economical roads around its cities is described by John V. Kiely on page 543.

A disputed point in riveted beam design, the question of proportioning shear by gross or net section, was investigated at Lehigh. Conclusion—net area should be used.

Another of W. G. Bowman's series of notes on engineering in the Southwest appears on page 548. Arizona takes the spotlight this time.

SUNSPOTS, among other things, will have a new meaning for water plant operators after they read next week's special waterworks number. The issue gives the answer to the question—what's new in water supply and treatment practice?

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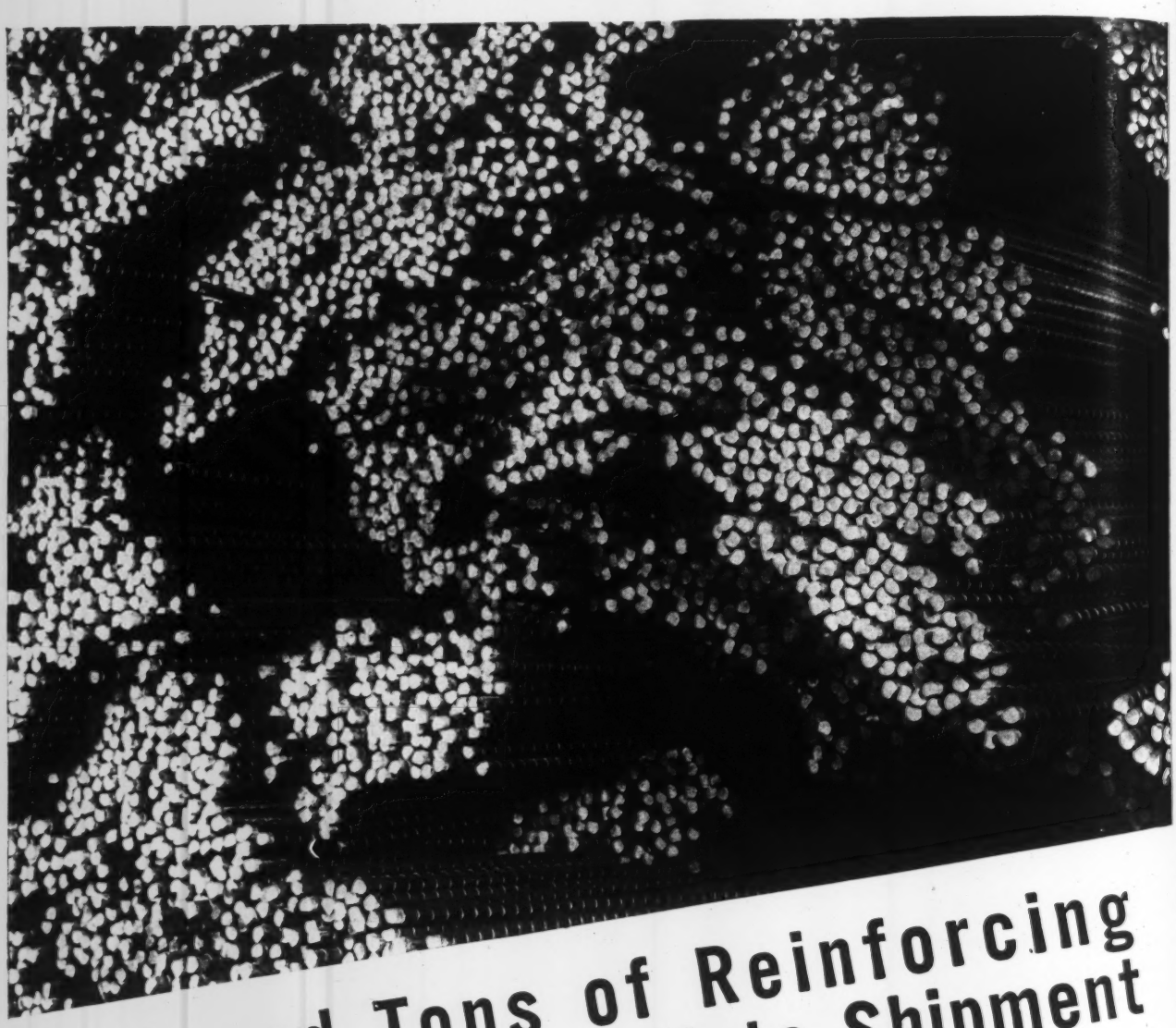
THE COVER PICTURE is of Mississippi River cutoffs in the Greenville bends, two of the thirteen that helped to reduce flood damage last spring. In the foreground is the short cut across Leland Neck, and beyond is the longer cut across Tarpley Neck. The river no longer passes Greenville, just off the picture at the lower right, but the harbor is served by the back channel in the center foreground.

U. S. Air Corps Photo
Courtesy Mississippi River Commission

Number of copies of this issue printed: 33,034



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THE WEEK'S EVENTS

State Water Storage Upheld by Court

New Hampshire Supreme Court holds constitutional act permitting self-liquidating projects

The New Hampshire Supreme Court on April 9 upheld the constitutionality of the New Hampshire Water Resources Board act of 1935 as amended in 1937. The Act establishes a state corporation empowered to build water regulation projects on a self-liquidating basis for flood control and power purposes. The projects are to be financed by payments from benefited water users, principally private utility companies.

The court held that the industrial and economic welfare of the state is "a proper reason to develop water storage for use in creating water power." It is not necessary, the court held, that projects be primarily for flood control purposes. "A development solely to develop and enhance power would have valid standing. . ."

Such benefits as might come to private utilities from the act, the court held, are incidental to the major purpose of benefiting the public. "The private users of the developed power from water storage may properly derive incidental benefits as an inducement to contract for the stored water; aid to them is not a reason for planning the project but is an item of the plan essential to make execution feasible and practical in the future."

Provisions of the act

The corporation set up by the act consists of a five-man state water resources board, of which Richard S. Holmgren is chief engineer. It is empowered to construct projects for conservation of water resources of the state, but each project must be approved by the governor and council of the state after public hearings; all contracts also must be approved by the governor and council.

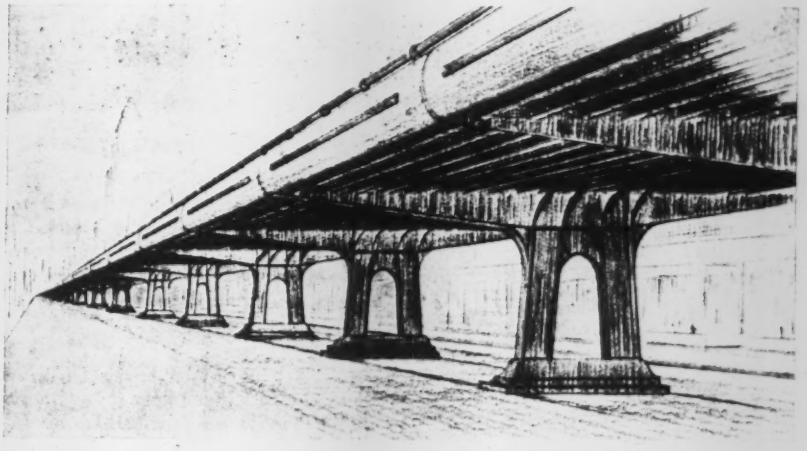
The board is empowered to issue revenue bonds not constituting a debt of the state, and in addition the governor and council may pledge the credit of the state to an amount not greater than $900,000.

The cost of the projects will be liquidated by payments from benefited water users. The board will make contracts, with a duration not greater than 50 years, with the water users. If any water user who is benefited by a project refuses to enter into a contract, the board may apply to the courts to fix the amount of compensation and manner of payment.

The board is empowered to obtain land for its projects by condemnation and it can also obtain court orders for the relocation of highways. Operation of the projects is to be directed by a water regulating committee.

The act also authorizes the governor and council to make agreements or compacts with any New England state for conservation, flood control and pollution control.

The first project planned under the act is a $2,300,000 dam and reservoir project at the head waters of the Connecticut River near the town of Pittsburg. It will have a storage capacity of 96,000 acre.-ft.



STREAMLINED DESIGN WINS ELEVATED HIGHWAY CONTEST

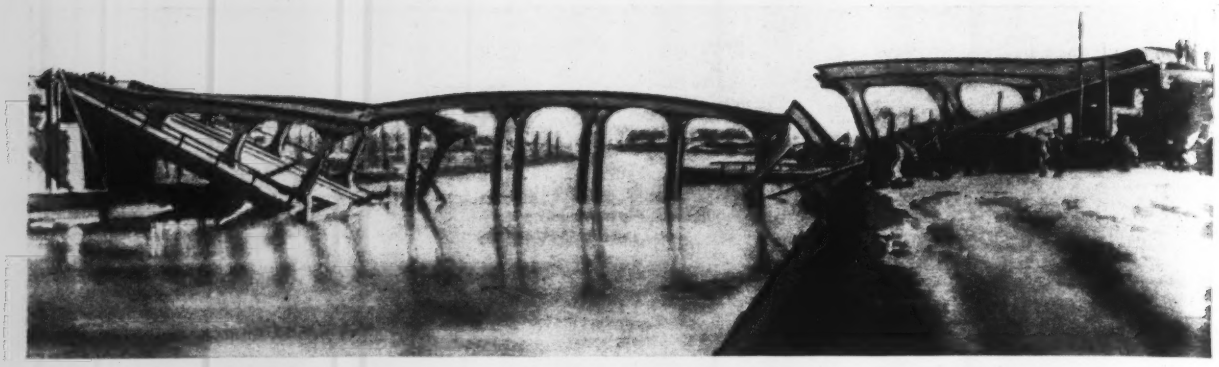
FIRST PRIZE in the contest for the design of an elevated highway held by the American Institute of Steel Construction went to this design prepared by Hazlett & Erdal, Chicago consulting engineers. A four lane roadway is carried on cantilevered floor beams supported on central bents. The legs of the bents rest on a center safety zone in the street below. Features of the design are the provision of divided lanes on both upper and lower street levels and the use of open flooring to permit a maximum of light underneath the structure.

The second prize was awarded to Madigan-Hyland, New York City, for a design which was used on the Henry Hudson Parkway in New York City north of 125th St.

Road Fund Bill Cut

Reporting the annual appropriation bill for the Department of Agriculture, the House Appropriations Committee, April 12, followed budget recommendations and cut federal-aid highway appropriations almost in half. The committee reduced federal-aid grants to the states from $150,000,000 to $63,000,000 and the appropriation for forest roads and trails from $12,500,000 to $7,000,000. The $2,500,000 provided this year for public lands roads was completely eliminated, but increases were granted for farm-to-market roads (from $5,000,000 to $10,000,000) and for grade crossing eliminations. The latter increase was from $10,000,000 to $20,000,000.

The report points out that since federal-aid allocations are obligations of the government additional appropriation must be made as payments fall due. The effect of the reduction is to divide the annual appropriation into two or more parts.



WELDED VIERENDEEL GIRDER BRIDGE COLLAPSES UNDER LOAD

COLLAPSING while a streetcar and several pedestrians were crossing, the welded bridge across the Albert Canal near Hasselt, Belgium, broke into three sections, as shown in this picture from the *Daily Telegraph & Morning Post*, London, of March 16. Failure was gradual, it appears, as all who were on the bridge reached safety. A local engineer says in a letter that failure apparently occurred at field splices. As will be seen from the picture, the left-hand break occurred at different panel points in the two trusses; the right-hand break apparently involved two separate splices in the top chord and a splice in a vertical. The chord breaks are at points of heaviest bending.

Charles R. Olberg Was Dam Specialist

Charles R. Olberg, whose death on April 4 at the age of 60 was briefly noted last week, had built dams and other hydraulic structures for many different agencies of the federal government as well as for various South American governments and for the Soviets. Olberg graduated from Columbia University in 1900 and did graduate work in hydraulics and mathematics there and at the University of California. He served for two years as assistant hydrographer for the U. S. Geological Survey and then became assistant engineer and later engineer for the U. S. Reclamation Service.

Four years later, in 1906, he joined the bureau of construction and repair of the War Department as a structural engineer but within a few months went with the Indian Irrigation Service as superintendent of irrigation and supervising engineer. He served with that agency until 1917, when he became captain and later major in the engineer reserves and served for 14 months overseas.

After the war, Olberg returned to the Indian Irrigation Service as assistant chief engineer, with general supervision over all projects in the western states. He had personal charge of the San Carlos project in Arizona, including the $12,000,000 Coolidge Dam, and of the Salt River project.

Olberg's connection with the Salt River project led to an invitation to Peru to initiate reclamation work there and to Argentina to take charge of hydraulic work in one of its provinces. On the completion of the Coolidge Dam, he went to the Soviet Union to act as consulting engineer on hydraulic problems in Transcaucasia. In this capacity he directed investigation and design of the $200,000,000 Mingechaur project.

Returning to the United States in 1933, he became an engineer examiner for the PWA. His service with that agency was terminated two years later by charges of improper conduct in connection with the Willacy County, Texas, irrigation project; he was later cleared of these charges. Olberg was indicted with others in March, 1935, for conspiracy to cause PWA to reject a plan of the Willacy County Irrigation District for an open canal and approve instead a pressure pipe system with specifications that would confine bidding to the use of redwood pipe (*ENR*, March 28, 1935, p. 464). These charges were dismissed in June, 1935, by the court, but on appeal the case was brought to trial. In June, 1936, Olberg, with the other defendants, was acquitted by the Supreme Court of the District of Columbia, and in July the American Society of Civil Engineers vindicated all of those involved (*ENR*, July 23, 1936, p. 135).

Since 1936, Olberg had been working as an engineer for the Farm Security Administration, most recently on a project in Amarillo, Texas.

• • •

Hardesty to Continue Firm

The engineering practice of the New York City firm of Waddell & Hardesty will be continued by Shortridge Hardesty under the name of Waddel & Hardesty. J. A. L. Waddell, the senior partner, passed away the early part of last month.

Court Holds for District In San Jacinto Case

The action of the Metropolitan Water District of Southern California in 1935 in taking over the work on the San Jacinto tunnel after the contractor failed to make satisfactory progress was upheld March 30 by a U. S. district court. The contractor, Wenzel & Henoch, Milwaukee, had brought suit for damages of more than $5,000,000.

The water district took possession of the work early in February, 1935 (*ENR*, Jan. 24, 1935, p. 141) on the grounds that the contractor had unnecessarily delayed construction of the San Jacinto tunnel. At that time, although about 30 per cent of the contract period had expired, the work was only about 17 per cent completed. The contract was awarded to the Milwaukee firm on its second low bid of $7,340,000, after the low bidder had failed to qualify.

• • •

Construction Contract Let For Possum Kingdom

Contract for construction of the Possum Kingdom dam on the Brazos River in Texas has been awarded by the Brazos River Conservation and Reclamation District to C. F. Lytle Co., of Sioux City, Iowa and Al Johnson Construction Co. of St. Paul, Minn. on their joint low bid of $3,287,000. The district also awarded 20 contracts totaling $453,000 for 1,200,000 lb. of steel for the dam.

Bids on 330,000 barrels of cement were all rejected by the district, however, and it is expected that this material order will be re-advertised.

THE CURRENT TREND

This week's news of contract volume and construction cost factors

Public Construction Up 31 Per Cent

Public engineering construction for 14 weeks of 1938 totals $395,047,000, a 31 per cent increase over the $302,361,000 reported by *Engineering News-Record* for the corresponding period in 1937. Federal awards, $82,012,000, and state and municipal awards, $313,035,000, make up the 1938 public total, and are 60 and 35 per cent higher, respectively, than the 1937 14-week volume. The federal gain is primarily due to the $34,442,000 contract for the high dam at Grand Coulee.

Public construction gain over the 14-week period last year is due to a 14 per cent increase in sewerage awards; 209 per cent increase in earth-work and drainage; 43 per cent in streets and roads; and 36 per cent in public building volume. Grand Coulee, Mississippi River Dams, material purchases for Marshall Ford and Possum Kingdom Dams, and large dredging projects are keeping earth-work and drainage at 3 times the volume of a year ago; Pennsylvania's institutional building program continues to swell the public building total; and large lettings for highway construction and municipal paving projects in various states are responsible for the high streets and roads volume.

Building Permits

Building permit volume for March totals $76,598,907, an increase of 42 per cent over the $54,010,213 reported by Dun and Bradstreet for February, 1938, but 37 per cent below the $121,118,706 reported in March, 1937. March permit volume in New York City reached $11,419,827, an increase of 88 per cent over February, but 68 per cent under last March volume.

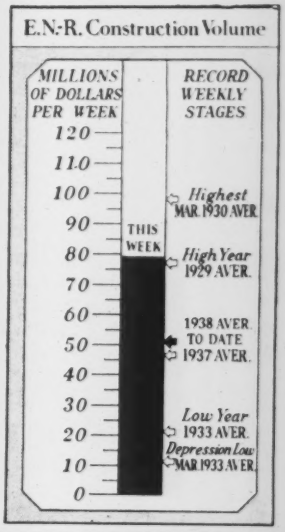
Construction Costs

The accompanying chart shows the complete graphic record of *Engineering News-Record* construction cost curve using common labor and of the building cost curve using the skilled labor trend. Also shown is the effect of substituting, beginning in 1935, 2″x4″ pine and fir average price for 20 cities for the 12″x12″ long leaf yellow pine price series heretofore used. (*ENR*, March 31, 1938, p. 453.)

For April *ENR* construction cost index at 237.95, and *ENR* building cost index at 198.21, are 0.3 and 0.5 per cent, respectively, below the preceding month, but are 3 and 2 per cent, respectively, above April, 1937. From the peak reached in October, 1937, construction costs have declined 1.6 per cent, and building costs, 1.3 per cent.

The lower April values are due to a drop in the 20-cities average 2″x4″ fir and pine price, which more than offsets increases in the common labor average of 0.2c., and in the skilled labor average of 0.3c.

A tabular record of the entire series of construction and building cost indices from 1913 to date will be published in *Engineering News-Record*, June 30.



THIS WEEK'S FIGURES

(Thousands of Dollars)

CONTRACTS

	Week Ending Apr. 15 1937	Apr. 7 1938	Apr. 14 1938
Federal	$4,270	$1,995	$4,393
State & Municipal	18,149	25,460	21,468
Total public	$22,419	$27,455	$25,861
Total private	24,508	12,096	53,512
TOTALS	$46,927	$39,551	$79,373

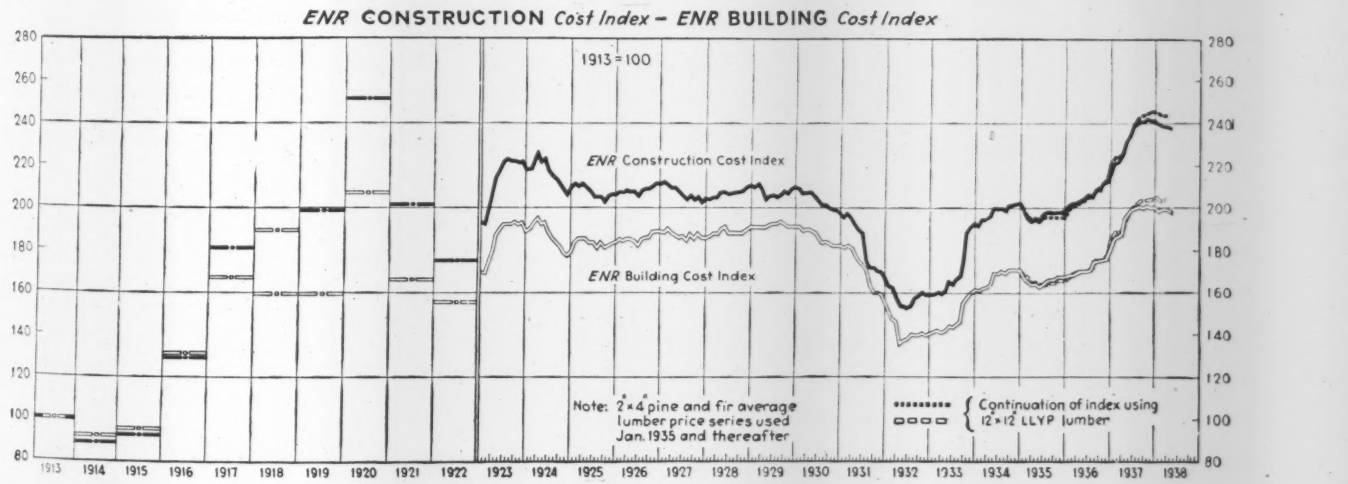
Cumulative
1938 (15 weeks) $777,709
1937 (15 weeks) 851,445

Note: Minimum size projects included are: Waterworks and waterways projects, $15,000; other public works $25,000; industrial buildings, $40,000; other buildings, $150,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1937 15 Wk.	1938 15 Wk.
NON-FEDERAL	$463,433	$367,743*
State & mun. bonds.	168,660	192,854*
Corporate securities.	219,072	78,050
PWA loans, grants.	46,562	2,417†
RFC loans	29,139	62,420
U.S.H.A. loans	.....	16,836
FEDERAL	.....	86,532*
TOTAL CAPITAL..	$463,433	$454,275

† Represents transfer from federal to private investment financing through sale by RFC of PWA bonds. * $24,330,000 state bonds replaced by WPA funds.


ENR CONSTRUCTION Cost Index – ENR BUILDING Cost Index
1913 = 100
ENR Construction Cost Index
ENR Building Cost Index
Note: 2"×4" pine and fir average lumber price series used Jan. 1935 and thereafter
Continuation of index using 12"×12" LLYP lumber
280
260
240
220
200
180
160
140
120
100
80
1913 1914 1915 1916 1917 1918 1919 1920 1921 1922 1923 1924 1925 1926 1927 1928 1929 1930 1931 1932 1933 1934 1935 1936 1937 1938

New Public Works Are Probable

President is considering a new program of public works pump priming

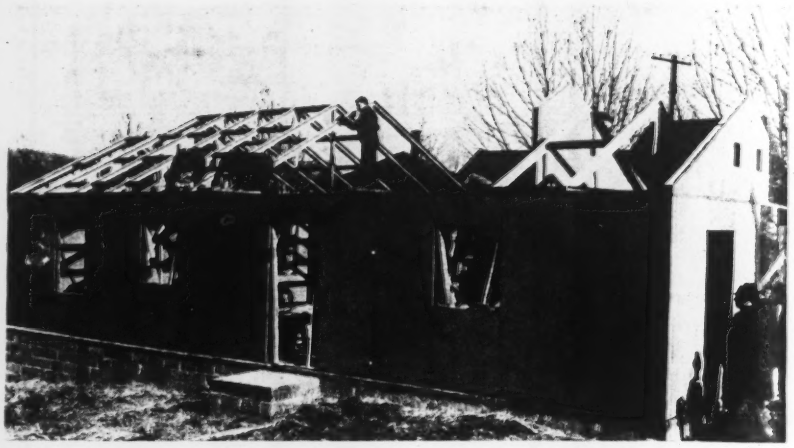
Washington Correspondent

Although no definite announcement had been made at the time of going to press, events in Washington indicate clearly that the administration is seriously considering the revival of large-scale pump-priming operations as a means of spurring employment and stimulating industrial activity. Details of the plan were still in a state of flux as the President consulted federal officials and Congressional leaders before preparing a message to Congress carrying his recommendations on what should be done.

In general, the plan is expected to provide low-cost loans to states and local governments to finance public works construction. This plan will supplement, but not replace, the continuation of WPA work-relief activities, for which an appropriation of $1,250,000,000 will be asked for the period from July 1, 1938, to Feb. 1, 1939. The amount of additional money that will be requested and the terms under which it would be obtainable, are still unsettled. General opinion indicates that the President will propose easier terms than embodied in the Glass bill (rushed through Congress last week) but not so liberal as under the old PWA program. The Glass bill permits the Reconstruction Finance Corporation to make public-works loans to local governments under terms to be determined by RFC, probably 4 per cent interest on the full value of the construction.

Congressional approval of the President's proposal is anticipated, despite the presence of a considerable economy bloc which argues that renewed spending will destroy confidence in the future. Congress is thoroughly alarmed at the continued failure of business to pick up and will be inclined to fall in with any plan that promises many additional jobs and a revival of business activity.

Suspension of PWA's financing activities last fall stranded approximately 3,000 approved projects on its waiting list. Should operations be resumed it is expected that many of these could be placed under construction promptly, but much depends upon the terms of the new program. Debt limitations will cripple many good applications if the idea of a 100 per cent loan is adopted, although this may be side-stepped in some cases if projects are legally self-liquidating.



STEEL HOUSE OPENED

ALL-STEEL experimental house was completed last month at Clairton, Pa., by Blaw-Knox. It is part of a development near the new Irvin Works of the new U. S. Steel Co. The five-room, 900-sq.ft. house is founded on concrete blocks resting on footings carried below the frost line.

External walls are constructed of standard prefabricated panels of wall height and either 40 or 20 in. wide. The panel frames are fabricated by welding from copper-steel channels. Inner and outer surfaces of the panels consist of sheet insulation 1 in. thick, leaving a 3-in. air space. Steel sheets are fastened to the insulation with an asphalt emulsion cement.

Pennsylvania Toll Road Gets WPA Grant

A WPA grant of $24,032,000 for construction of a $50,000,000 toll road between Harrisburg and Pittsburgh has been approved by the President. The proposed four-lane parkway, which would follow the right-of-way and use the roadbed and tunnels of the old uncompleted South Penn R.R. is to be built by the Pennsylvania Turnpike Commission and financed, in addition to the WPA aid, by a bond issue.

The commission has announced that a New York firm has agreed to purchase as much as $60,000,000 of turnpike bonds. The commission was authorized to issue bonds by the 1937 Pennsylvania legislature.

• • •

Empty New York Tenements To Be Demolished

A bill permitting the New York City Department of Housing and Buildings to tear down vacant and dangerous buildings at the expense of the city has been signed by Governor Lehman of New York. Provisions of funds for such work is not to depend upon appropriation by the city; if there is no appropriation, funds are to be provided from the sale of tax notes by the city comptroller.

The bill provides that a multiple dwelling be regarded as an untenanted hazard if it has been vacated for a period of 60 days and is either not guarded by a resident caretaker or is a fire hazard or is in a condition "dangerous or detrimental to human life, health or morals." The owner of an untenanted hazard is to be notified that the building is to be demolished. If demolition is not started within three weeks, the department will then seek a court order to demolish.

• • •

New York Parkway Bills Vetoed by Governor

Governor Lehman of New York on April 11 vetoed six bills which would have appropriated $4,043,000 for parkway and bridge construction in the New York City area and in Monroe County (*ENR*, April 7, 1938, p. 494). The parkway improvement program in the state for 1938 is thus limited to the $3,835,000 which was provided in the executive budget submitted early in the 1938 session of the legislature and passed by both houses.

In a memorandum accompanying the veto, the Governor pointed out that most of the proposed projects would only be started by the present appropriation and that they would involve a yearly expenditure of about $4,000,000 for several years; he said that the state could *not* assume this financial burden.

Hetch Hetchy Sale Is Enjoined

Court orders San Francisco to stop sale of Hetch Hetchy power by October

Federal Judge Roche on April 11 held that the city of San Francisco, Calif., has been violating its agreement with the federal government by selling power from its Hetch Hetchy development to the Pacific Gas & Electric Co. under an "agency" contract.

The district court issued an injunction effective Oct. 11 prohibiting the sale of Hetch Hetchy power to the Pacific Gas & Electric Co. for resale to the company's consumers. Judge Roche ruled the government was entitled to an injunction under the terms of the Raker Act and said that the only alternative would be to take Hetch Hetchy away from the city entirely, canceling generation and transmission rights. He said he had given six months' grace because the city has been operating under contract with Pacific Gas & Electric for thirteen years.

The Hetch Hetchy development, which is primarily for water supply, is located partly upon federally-owned lands. The use of these was granted to the city under the Raker Act on condition that none of the incidental power developed should be turned over to a private corporation for resale. For more than ten years the power has been carried to San Francisco by the company under a temporary contract under which, the city contends, the company is merely acting as its agent. Meanwhile San Francisco voters have on four occasions refused to vote bonds for a municipal power system.

The present suit was instituted a year ago by Secretary Harold L. Ickes to force the city to discontinue its present arrangement with the company.

The city is expected to appeal the case to the higher courts. City officials state that the present arrangement brings the city an income of about $2,000,000 from the company and that carrying out of the decision would increase city taxes about 28 cents per $100.

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World Conference Called On Silicosis

The International Labor Office has summoned a world conference on silicosis to be held in Switzerland next September. This will be the first world conference on the subject since that held by the I.L.O. in South Africa in 1930.

HERBERT W. ALRICH

Engineer of the Consolidated Edison Co., whose death on March 25 was noted in last week's issue

Precast Concrete Lining For London Subways

A concrete lining of precast segments bolted together is to be used on a 2½-mile section of subway tunnel in the northeastern section of London, England. All previous subway tunnels in London have been lined with cast iron segments, but the increasing difficulty of obtaining cast iron, due to the armament program, has led to the change. The London Passenger Transport Board has awarded contract for supplying the concrete segments at a cost of about $360,000 for the 2½-mile section.

The segments used are strongly reinforced and about 2 in. thick. The total weight is comparable with that of the ⅞-in. cast iron segments previously used, so that it is still possible to place the lining by hand. The bolt holes in the segments are lined with steel ferrules and local reinforcement is placed around the holes.

The decision to use the concrete lining was preceded by a number of extensive tests which included construction of experimental tunnels 8.5 ft. and 12 ft. in diameter loaded with 175 and 228 tons of iron, respectively. In addition, full size rings were placed in a tunnel under construction to determine whether they would stand the thrust of the hydraulic rams employed to push the shields forward. The concrete rings were adequate on all tests.

Bids Are Asked For Shasta Dam

Bids to be opened June 1 on second largest concrete dam in the world

Bids for building Shasta Dam and power plant, part of California's Central Valley project, will be opened by the Bureau of Reclamation on June 1. This announcement follows closely on a call for bids on the temporary railroad tunnel under the dam site.

The work of building the dam and power plant will include 3,215,000 cu. yd. of earth and rock excavation, and placing 5,610,000 cu.yd. of concrete and 26,000,000 lb. of reinforcement steel. It will be necessary to install 13,600,000 lb. of large penstock and outlet pipe, 8,000,000 lb. of small tubing for cooling and grouting, and 12,870,000 lb. of steel gates and control mechanisms.

Shasta Dam will be among the largest in the world. Its concrete yardage of 5,610,000 cu.yd. is greater than the 3,250,000 yd. in Boulder Dam and is topped only by the Grand Coulee high dam, which will have, when completed, a yardage of 9,740,000. Although not as high as Boulder Dam, Shasta will be higher than Grand Coulee.

Bidders will be required to post a $2,000,000 guarantee with each bid, and the successful bidder must provide a performance bond of $5,000,000 and a labor and material bond of $2,500,000. Two thousand calendar days will be allowed for the job.

Shasta Dam will be a gravity section concrete structure with a slightly curved axis; with a height of 560 ft., it will have a crest length of 3,400 ft. and a width at the base of 580 ft. It will back up the waters of the Sacramento, Pit and McCloud rivers to create a reservoir with a storage capacity of 4,500,000 acre-ft.

The dam will have a 375 ft. overflow spillway at the center and fifteen river-regulating outlets through the dam. Five 14-ft. penstocks will lead to a 350,000 kw. power plant.

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Tugwell Named to Head N. Y. Planning Board

Rexford V. Tugwell has been appointed chairman of the New York City city planning commission, to succeed A. A. Berle, Jr., who resigned last month to become Assistant Secretary of State. Until early last year, Tugwell was Under-secretary of Agriculture and head of the Resettlement Administration.

Federal-Financed Jobs Strike in St. Louis

Building trades workers walk out protesting independent union on federal-aid bridge job

Work on more than a dozen building and construction projects financed partly or wholly by federal funds in the St. Louis, Mo., area has been at a standstill since April 4. On that date, a general strike on federally financed work was called in an effort to force the Massman Construction Co. of Kansas City to employ A.F.L. labor on a $390,000 repair and improvement job on the St. Charles bridge across the Missouri River. The St. Charles bridge job, which was let by the Missouri state highway department, is being financed in part by federal highway aid allotments.

The strike, briefly noted in last week's issue, was stated by secretary Church of the St. Louis building trades council, to affect 6,000 union workers. Chief resident engineer Williams of the PWA, however, said on April 4 that less than a thousand men had responded to the strike order on nine projects involving $7,024,000. This estimate did not include non-strikers prevented from working by the strike and did not include the carpenters, who went on strike a few days later.

The Massman company recently signed an agreement with the Independent Workers Organization of St. Charles, which is not affiliated with either the A.F.L. or the C.I.O. The contract provides for wages ranging from 67½ cents an hour for laborers to $1.50 for steel workers.

The independent organization was formed during recent disputes in the St. Louis area between the A.F.L. common laborers union and the U. S. Engineers over wages to be paid to WPA labor on reservoir clearing and levee building projects. A general strike such as the present one was threatened in the course of that dispute, but the threat was withdrawn after the union had obtained a 90 cent an hour wage scale on the levee job and the U. S. Engineers shut down work on the reservoir clearing operation.

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48-Hour Week in New York Vetoed by Governor

A bill which would have permitted use of the 48-hour rather than the 40-hour week on state projects of a seasonal nature (*ENR*, April 7, 1938, p. 491) was vetoed by Governor Lehman of New York on April 4.

Park Service to Buy Historic Canal

Plans have been completed for acquisition by the National Park Service of the entire length of the historic Chesapeake and Ohio canal, extending from Washington, D. C., to Cumberland, Md. The 186-mile strip will be developed for recreational purposes, according to present plans, and it is possible that part of its length will be utilized for the proposed Washington-Gettysburg memorial boulevard.

The National Park Service will purchase the canal from the Baltimore & Ohio R.R. with the profit made by the Reconstruction Finance Corp., on the resale to the public of PWA bonds. RFC has made it a practice to turn such profits back to the Secretary of the Interior.

The amount to be paid for the canal is not stated, but the amount available from RFC is $2,500,000, which will cover both purchase and development of the canal.

The canal was first incorporated by the Virginia legislature in 1823, and its charter was affirmed by the state of Maryland and by Congress. Construction started five years later and traffic was first moved in 1830, although the full length was not finished until 1850. The waterway was last used in 1924. Paralleling the Potomac River, the canal includes a number of locks, 11 aqueducts, seven diversion dams and a tunnel 0.6 mi. long. It cost approximately $15,000,000.

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Commission Approves Sale Of Nebraska Utility

The Federal Power Commission on April 8 announced its approval of the sale of the Southern Nebraska Power Co. of Superior, Nebr., to the Central Nebraska Public Power and Irrigation District for $898,000. The commission's order states that the price to be paid appears not unreasonably high since "it will permit a rate reduction by the purchaser aggregating approximately 20 per cent of the Southern Nebraska Company's present revenues through the sale of electric energy." The proposed sale, the commission holds, will aid in the district's program of rural electrification and of coordination of hydro-electric plants on the Loup and North Platte rivers.

The three Nebraska power and irrigation districts, the Central Nebraska, the Tri-county and the Loup, are understood to be negotiating for the purchase of all the private utilities in the area they serve in order to form a unified public system.

LABOR NOTES

FIRST APPLICATION by the Newa[illegible] N. J. Building Trades Council of [illegible] plan to reduce strikes on buildi[illegible] projects occurred April 1 when the council refused to sanction a strike called by the carpenters' union. The carpenters struck an apartment house job, alleging that wages lower than the scale were being paid. Stating that the carpenters had not sought arbitration, the council ordered other trades to continue working with non-union carpenters.

The arbitration plan, adopted last month, provided for arbitration of jurisdictional disputes and forbid strikes for wage increases during the duration of building projects.

A WAGE INCREASE of a dollar a day over the previous $11 scale is sought by Pittsburgh painters. The Painters District Council No. 1 is negotiating a new contract to replace one expiring March 31. The union states that several employers have agreed to the increase, but this is denied by the employers' association.

A RETROACTIVE wage increase is sought in a suit brought against the city of Cincinnati by a member of the laborers' union. He has been working, he says, on a relief project at a rate of 25 cents an hour, whereas a state law requires that prevailing wages be paid on all city work. Prevailing wage for laborers is stated to be 75 cents an hour. The city has been ignoring the law for 2½ years, and officials state that if the claim is allowed, back wages of about $1,250,000 would be chargeable against the city. In addition an equal amount would be chargeable as a penalty under the state law. Union representatives said that the union does not object to the low rate on made work, but does object where projects replace work they say should be done at prevailing rates.

COMPULSORY incorporation of trade unions has been put into effect in the province of Quebec by a bill passed by the provincial legislature April 7.

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Queens Tunnel Award

Charles F. Vachris, Inc., of Brooklyn, has been awarded contract No. 7 of the Queens Midtown Tunnel on a low bid of $2,229,000. Contract No. 7 covers the Queens land section from the Queens construction shaft to the Queens portal.

Institutional Building Started in New York

State appropriates $21,000,000 for construction of prison and hospital buildings

An appropriation of $21,385,000 for construction of mental hospitals and prisons has been passed by the New York State legislature and signed by the Governor. The appropriation marks the beginning of a program of institutional construction which is to be financed out of a $40,000,000 bond issue approved by popular vote last fall.

The appropriation bill makes the funds available immediately, although little actual construction work is expected to be accomplished during the current year. The State Department of Public Works plans, however, to push several projects to the contract stage during the summer and has added to its staff of architects and draftsmen.

The $40,000,000 program will be spread over the next three years, and when completed will provide accommodations for 13,400 additional inmates at the various institutions.

Among the larger projects to be undertaken at once are a new $5,250,000 school for mental hygiene patients, a new prison to cost $6,000,000, and additional facilities at various existing state hospitals.

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New York City and WPA Work Out Program

A new plan of cooperation between the city and the WPA administration has been announced in New York City, whereby the city will contribute its share of the works relief program by paying the material and equipment costs of construction projects. Formerly the city contributed about $750,000 a month from its home relief funds, raised mainly by special taxes, which the WPA used for equipment and materials. Under the new plan the city will let contracts for materials and equipment rental for specific projects, and the WPA will furnish all the labor and supervision. Bids have already been taken for the first project under the new plan, a large storm drain on Staten Island.

The change was necessary because of the lack of sufficient funds under the old plan properly to carry on the type of work relief projects available in the city. The type of project on which expenditure is largely for labor is becoming rare within the city, forcing relief authorities to turn to more substantial construction work. In fact, for some time the WPA has been carrying on construction work of every conceivable type. It has not been possible, however, to plan a definite program that will utilize the labor strength of WPA to best advantage.

Projects selected for construction under the new plan are those set up under capital outlay expenditures of the city and those coming under assessment financing. For the most part the projects are of the type that would be done some day by the city, but not at present. Sewers, water mains, pavements, schools, replacement of wharf and pier sheds, park facilities and playgrounds are some of the types of work that will be considered. The plan will result in a lower cost for such work to the city and assessed property owners, and at the same time will give the WPA a definite program to work on.

At present WPA expenditures in the city run $180,000,000 per year.

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Insurance Company Plans Big Housing Project

A 120-acre housing development in the borough of the Bronx, New York City, is to be undertaken by the Metropolitan Life Insurance Co. It is understood that a development to include at least 12,000 housing units and to cost about $35,000,000 is projected, with the possibility that the plans will be enlarged to house as many as 20,000 families.

The project is being undertaken under the terms of a recent amendment to the New York State insurance law permitting insurance companies to invest their funds in low cost housing projects. The project, designed for families of moderate and low incomes, is understood to be the one to which Mayor La Guardia referred last week in a speech to city building and labor interests. (*ENR*, April 7, 1938, p. 489).

The construction contract has been let to Starrett Bros. & Eken, Inc., of New York City, and a board of design has been set up. Chairman of the board of design is R. H. Shreve of the architectural firm of Shreve, Lamb & Harmon. Henry C. Meyer, of the engineering firm of Meyer, Strong & Jones, will also be on the board, as will Gilmore D. Clarke, city planning engineer, and Irwin Clavan, one of the associated architects on the Williamsburg housing project in Brooklyn. Andrew J. Eken, representing the contractor, and George Gove, manager of housing projects for the insurance company, will also be on the board.

WASHINGTON HIGHLIGHTS

Special reports by Paul Wooton

ONE MORE MEMBER has been added to the TVA inquiry board. After Senators McNary and Borah, Republicans, refused to serve, Vice-President Garner appointed Senators Capper and Frazier in their places. Senator Capper, however, refused to serve.

A NEW WAGE BILL was reported on April 6 to the House Labor Committee by a subcommittee. The bill would set up a 48-hour week and would empower a labor standards board to establish as the minimum wage in an industry a rate five cents an hour greater than the existing average wage in that industry. This process would be repeated every year until the minimum wage was raised to 40 cents an hour.

A PLEA THAT Congress investigate Nebraska's "Little TVA" at the same time that it probes the affairs of the Tennessee Valley Authority has been sent to all Senators and Representatives by the Platte River Water Protective Association, which has over a thousand members resident in nine Nebraska counties.

A BILL to amend the Federal Power Act by liberalizing the procedure for procuring court review of actions by the Federal Power Commission has been introduced by Sen. Bailey. The bill would permit any person, state, municipality or state commission adversely affected by an order or finding of the commission, to appeal to the federal courts for review whether or not it has been a party to the proceeding. At present only parties to the proceeding have the legal power to carry an order to court.

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Zeppelin Hangar Fails In Germany

A 160-ft. girder in the Zeppelin hangar under construction at Frankfort on the Main, Germany, buckled and brought down a part of the roof on March 30, according to press reports. Six workmen were killed and six injured.

The structural framework had been completed ten days before the accident. Work is now halted pending an investigation into the cause of the accident.

News continued on page 553

COMMENT AND DISCUSSION

Readers' opinions on matters that concern the engineer

Who Was T. N. Boutelle?

Sir: Can any of your readers add to the scanty information available about one of the pioneer designers of water filters in America? T. N. Boutelle designed waterworks for Marshalltown and Burlington, Iowa, in 1876 and 1877, each of which included filters. He also designed works for Monticello, Fort Dodge and Boone, Iowa, and was constructing engineer for works at Hannibal, Mo. All this was from 1876 to 1884.

In the recent article on the history of the waterworks of Marshalltown (*ENR*, Mar. 17, 1937, p. 407) Boutelle is rather slightly described as an engineer who came to that city "'from some place in the East' and doubtless he just 'stopped off between trains and persuaded the council to employ him'". I can find no positive evidence that Boutelle was an eastern engineer. The article gives Boutelle more but yet incomplete credit by saying that he built "one of the first filter plants in the Mississippi Valley." The Marshalltown filter, so far as I can find, was the first notable filter farther west than the three in the James and Hudson valleys. One at Richmond, Va., was put in early in 1832 and then came a gap of 60 years until the Poughkeepsie and Hudson filters of 1872 and 1874. For reasons that need not be gone into here, the Richmond filter was a failure and those on the Hudson a success.

Even if Boutelle went to Iowa from the East and knew of the filters at Poughkeepsie and Hudson, both uncertainties, is it to be wondered at that he did not propose a settling reservoir and a large filter for an Iowa city of a few thousand population? At Marshalltown and the next year at Burlington he covered his filters. This was feasible because the filters were small and so narrow as to be easily spanned by a single arch. If Boutelle had submitted estimates for a settling reservoir and a covered filter of ample size, the Marshalltown council would have been filled with consternation if not indignation at the cost. The entire waterworks—filter, pumps, mains, and hydrants—cost only $47,000, the article under consideration states. Only ten years earlier, the members of a special water commission at St. Louis were forced by the city council to resign because they had approved tentative plans for filters and sent James P. Kirkwood to Europe to gather data to aid him in designing them. The new commission wrote Kirkwood to hurry back and design works without filters. A half century passed before St. Louis had filtered water. American cities in general were not willing to pay the price for purified water until the 1890's and later.

Honor should be given to the engineers of the 1870's and 1880's who attempted to cope with the situation in the face of public ignorance and indifference and of their own inexperience. T. N. Boutelle was notable among these pioneers. Who can and will add to the meager information available regarding his professional education and practice? He appears at Marshalltown in 1876 and disappears at Boone, Iowa, in 1884. During this short period he designed filters for two of the few American cities that attempted filtration in those eight years. At Fort Dodge he sank inverted plate-iron tanks in the gravel beneath the Des Moines River to obtain clear water.

M. N. BAKER
Upper Montclair, N. J.

Road Costs and Benefits

Sir: Years of work with alternating currents have, perhaps, given me a reluctance to use vector analysis except where it is unavoidable. It seems to me that Mr. McCullough has made his approach to the problem of "Evaluating Highway Extensions" (*ENR*, March 3, 1938, p. 330), unnecessarily complicated. This arises from his use of ratios instead of simple quantities.

It will be noted that in his Figs. 2 and 3 (p. 332) all x components and all y components have the same denominator: $K_1 C_2$. Thus, dollars of revenue can be plotted on the one axis and dollars of benefit on the other without changing the result. Now if, for the term "revenue," we substitute the phrase "cost to the using motorists" we see that there is a definite, linear relationship between total benefits and net costs to using motorists (or net revenue), and the one can be subtracted from the other to get the value of the project to those motorists using it.

Similarly the costs to the using motorists can be subtracted from the annual road cost (or cost to all motorists); the result, whether plus or minus, will determine if the improvement will be self-sustaining or if the motorists at large must subsidize it for the benefit of the group which will use it.

Linear treatment also makes it possible to compare one large project with several small ones, which would be more cumbersome vectorially.

D. F. PANCOAST
Manager, Ohio Highway Planning Survey
Columbus, March 11, 1938

Cold Twisting of Steel

Sir: A letter published in your issue of March 17, p. 390, by D. B. Steinman, might give one the impression that the strength of structural steel reinforcing bars is increased due to cold twisting. That this is so only with qualifications is brought out by the following tests. The actual or true strength of steel is not increased by cold working.

Three hot worked round steel rods, C-0.2% approximately, were tested in direct tension as follows:

1. Plain round ¾-in. diam.
2. Plain round ¾-in. diam. with V-notch.
3. Plain round ¾-in. diam. twisted in torsion to fracture.

Bar No.	Ultimate Strength lb. per sq.in.	Reduced Area, %	Tear Resistance lb. per sq.in.
1	54,000	68	122,000
2	83,000	23	107,000
3	91,000	0	91,000

Briefly, the phenomena which occur during the tension test are these: When steel reaches the yield-point, inter-crystalline slipping takes place which forms the basis of the yield phenomenon and strain hardening sets in. As the load increases, yielding and strain hardening continue.

The material in bar No. 1 re-

mained sufficiently ductile to become reduced in cross-sectional area, especially after the maximum load had been reached. Necking occurred and the fracture was of the typical cup and cone type. Bar No. 2 fractured at right angles to the axis of the piece with much smaller reduction of area, the necking being inhibited in this case. Bar No. 3 had been so much strain-hardened by twisting that there was no measurable reduction of area and the fracture was square across with the same appearance as that for very hard steel.

The "ultimate strength," which is computed on the basis of the maximum load and the original cross-sectional area, increases, not because the strength of the steel has been increased, but because its ductility has been decreased. The tear resistance is not increased due to cold working, but the slip resistance does increase. In the present instance there appears to be a lowering of the tear resistance due to possible stress concentration and to excessive twisting in bars No. 2 and 3 respectively. It is believed, however, that the true strength of a metal, where cold working has not been excessive, remains the same.

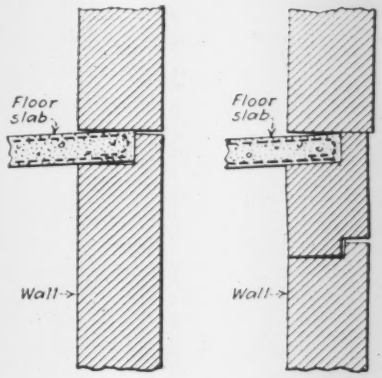
As there appears to be an impression among engineers that cold working improves the strength of steel, this rather brief discussion may help to place the matter on a rational basis. The "ultimate strength" is, to be sure, increased, but it is not the only basis for comparison.

I. F. MORRISON
Professor of Applied Mechanics, University of Alberta, Edmonton.

Cracks in Walls

Sir: The issues of *Engineering News-Record* for Dec. 30, 1937, and for Jan. 13 and March 17, 1938, report serious cracking of the walls in nearly all of the federal housing projects and suggest that the phenomenon is due to shrinkage of the slabs. I believe that this explanation is totally inadequate.

The ratio of depth to span for some of the slabs in these buildings approaches 1/30, so that large deflections are to be expected and the rotation of the tangent to the elastic curve at the wall support should have been carefully considered. I have not examined any of these buildings but the slabs are probably embedded in the walls to a depth



How floor-slab deflection can cause the brick supporting wall to crack

of 8 in. and probably act upon the walls in such manner as to produce effects similar to those which are suggested in the adjoining sketches.

BART J. SHINE
Professor of Structural Engineering, University of Cincinnati
Cincinnati, O., March 24, 1938

Parabola Solution

Sir: On reading C. E. Sharp's article on p. 799 of the Nov. 11, 1937 number of *ENR*, I decided to send in a little information on parabolas that is often helpful.

D = difference in elevation of end of base line.

L = span or horizontal length of parabola.

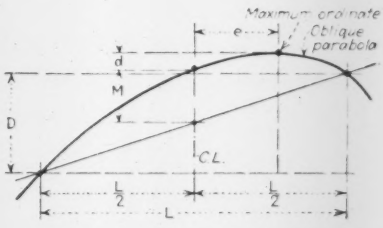
d = added height from point on curve at center of span to maximum point.

M = middle ordinate of curve.

e = distance from D. L. to maximum point.

$$d = \frac{1}{8}\,\frac{(d)}{M}\,L \qquad (1)$$

$$d = \frac{1}{16}\,\frac{(D)}{M}\,D \qquad (2)$$



Formulas (1) and (2) may be used to find maximum ordinates on highway curves and on moment curves for continuous structures and to find the positions of maximums for ease and accuracy of plotting.

C. W. DEANS
Estimator, Western Bridge Co., Ltd., Vancouver, B. C.

Texas Law Liberalized

Sir: I notice on page 996 of your Dec. 16 issue a news report entitled "Texas Bars Non-Residents on Highway Contracts."

The State Highway Commission on April 12, 1932, passed an order that contractors bidding on state jobs must have done work of construction or improvement on Texas highways at least six months prior to April 12, 1932. Under the old order, passed April 12, 1932, you can readily see that the prequalifications for such contractors became more rigid each year, because they must first have done the work of construction on Texas highways six months prior to April 12, 1932.

The recent order passed by the commission simply stated that bidders must have performed such work on Texas highways at least twelve months prior to the date of the letting at which such firm desires to bid. In other words, the prequalification for such contractors is a maximum of one year instead of an increasing maximum each year, from six months prior to April 12, 1932.

JULIAN MONTGOMERY
State Highway Engineer
Austin, Texas

Nicaragua Canal

Sir: I see that the project of a Nicaragua Canal is being revived, the excuse given being that the Panama Canal might be damaged by an enemy bombing it. It would seem that any enemy force having sufficient control of the air to bomb the locks of the Panama Canal would also the same day bomb the Nicaragua Canal. It seems to me that the best way to avoid such an event and also probably save a few hundred millions of dollars, if saving is any object these days, would be to revert to the original plan for Panama and make it a sea-level canal. This could be done by cutting back the banks of the Culebra cut, removing the material in dump barges or otherwise. This could be done gradually, also any necessary dredging in other parts of the canal and the removal of the present dams and locks. If this is done, the time saved by the passage of a sea-level canal would offset the shorter distance by Nicaragua and seems to be worth consideration.

ROBERT S. SMITH
Biloxi, Miss., March 5, 1938

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Editorial Offices at 330 West 42nd Street, New York

APRIL 14, 1938

THANKS ARE DUE the American Institute of Steel Construction for its enterprise in bringing the problem of elevated highway planning to wider attention through its design competition. No urban condition is more obvious than the inadequacy of means of transportation within and through cities. The present-day city is choked by its layout; its vital circulation must pass through a meshwork of capillaries lacking the arteries essential to free blood supply, and as a result its tissue is deficient in vitality and becomes more flabby every day. Sporadic attempts have been made by a number of cities to cut thoroughfares through their antiquated street networks, but generally the situation has been little improved, for even widened and straightened streets still have their intersections, which despite large expenditures for traffic-control signaling mean delay, danger and deaths. Thoroughfares without intersections are the necessary answer, and of these elevated highways are one promising form, in many instances the only form readily applicable. Study of the possibilities of elevated highway construction is therefore most timely, and if its results received the public attention they deserve we may look hopefully for improvement of present conditions of city transportation.

Pump-Priming and Enterprise

ALL CURRENT FIGURES SHOW that the slackness of business and industry which makes the present depression is due not to reduction in public works or public employment but to stoppage of private enterprise. Five years ago, when the Public Works Administration was set up to revive employment and industry, a radically different condition existed: Public-works construction had largely been halted through breakdown of the financial system, and in turn a huge volume of industrial and business activity dependent on this primary work was made idle. The pump-priming that was logical and effective at that time carries no promise of meeting the present depression. Rather, what the situation demands is encouragement to private initiative, not increased government spending. Washington proposals of a large pump-priming program of public works suggest an official philosophy quite at variance with the realities, since by no possibility can the governmental works expenditures be increased sufficiently from their present 2½ to 3 billion annual rate to fill the gap left by the decline of initiative and enterprise. Even the extreme step of making lavish gifts to cities and states in the form of no-interest "loans"—loans unlikely ever to be repaid—cannot be effective in really priming the pump of business initiative. It is more likely to reduce initiative still more and intensify the depression.

Reflectorized Roads

PRAISEWORTHY PIONEERING is being done by Michigan in the reflector-marking of the Detroit-Lansing highway and its planned extension. The inauguration of the initial section last week laid fitting emphasis on a safety effort that is in line with recognized need and best-informed judgment. Marking the course followed by the road ahead and making the pavement edge visible are two neglected safeguards to night driving. So long as full and adequate illumination of the road cannot be had, the roadbuilder can at least provide assurance that the unpaved shoulder is not dangerously close and supply a guide to the alinement of the road. Curb marking has only begun to receive attention on even the most congested routes. Alinement marking is realized for the first time in the Michigan installation. It carries forward into wholly new service the effective use of reflectors for direction arrows and other special warning signs that already are in wide use. In principle it is like the line of reflectors embedded in the curb now being installed on the new Merrick parkway in Connecticut and experimentally in other states, but it gives promise of much large usefulness. At low cost and with little operating or upkeep expense it provides a compelling guide action from which a large gain in night safety may be expected.

Page the Building Inspector

BUILDING OFFICIALS met in their annual conference in Washington two weeks ago, discussing their own business—which is the public's business—of assuring safe building. They have been doing this for a good many years; yet they remain an unknown and unappreciated tribe, men who must find their reward in heaven if anywhere. Performing one of our vital public services, that of guarding public safety and private investment in building, they are about as popular as revenooers in a moonshine district. One conception of the building inspector is that he is a broken-down mechanic with an inferiority complex, who loves to bawl out the architect and whose ambition is to bankrupt the builder by insisting on some sense-

less code rule. Instead, he will usually be found to be an able building engineer who combines a practical knowledge of architecture, structures and building with an active conscience, and who strives for the essentials of good building with least possible harassment to all concerned. Our building progress is largely in his hands; improved codes help, but the inspector's work is what makes the progress real. He deserves better understanding and support, most particularly on the part of the engineering profession, whose objectives he furthers.

Permanent Flood Safety

WHAT CAME TO PASS in the tense winter days of last year, when the tremendous volume of water that gorged the Ohio River channel threatened to overwhelm the Mississippi's defenses, was well reported in the news accounts of the time. But until now no official record has been made public of the performance of the Mississippi flood-control system—the works begun ten years ago to put a final end to the river's menace. Gen. Schley's excellent account on the leading pages of this issue provides the missing information.

For the first time in the river's history a great flood was carried between the levees; The levee line held without indication of structural weakness. The Bird's Point floodway, operating for the first time, lowered the water at Cairo enough to permit the city to be saved—almost by a miracle. Flood stages between the Arkansas and the Red were so greatly reduced by the cutoffs as to make this dangerous section seem relatively safe, even without the proposed bypasses. And in the lower section of the river the Bonnet Carre spillway, performing as intended, demonstrated that New Orleans has been made safe. The 1937 record is one of gratifying success.

There remains the question as to future floods, however. Will the same protective system that barely withstood last year's test—with many miles of the works on the verge of overtopping—keep the valley safe in floods yet to come? The flood control voted by Congress in 1928 was intended to end the Mississippi problem for all time; the system must meet this greater test as well as the test of 1937, or it is a failure.

When one recalls the fear that prevailed during last year's flood, the alarm of the river engineers as well as of farmers and citizens behind the levees, the apprehension that catastrophe was approaching, the preparation of plans to evacuate the entire bottomlands, and finally Cairo's narrow escape, it becomes evident that the works have no safety margin. They would hold another 1937 flood: but nothing more. Inevitably, the future adequacy of the Mississippi system is in question. The safety of the valley has not been assured.

May there not be greater floods, and, if so, would not destruction engulf the basin areas, many feet below the levee tops? In 1937 only the Ohio was at high flood, and little water came from the other tributaries; what if these also should send down their share? In short, how big a flood may occur, and how well would the control works resist it? How could the dangerous pocket at Cairo be held?

Vital questions of this kind await answer before the people who live behind the high levees can feel assured of safety. They look to engineers for the answer, and the answer has not yet been given.

One-Sided Dealing

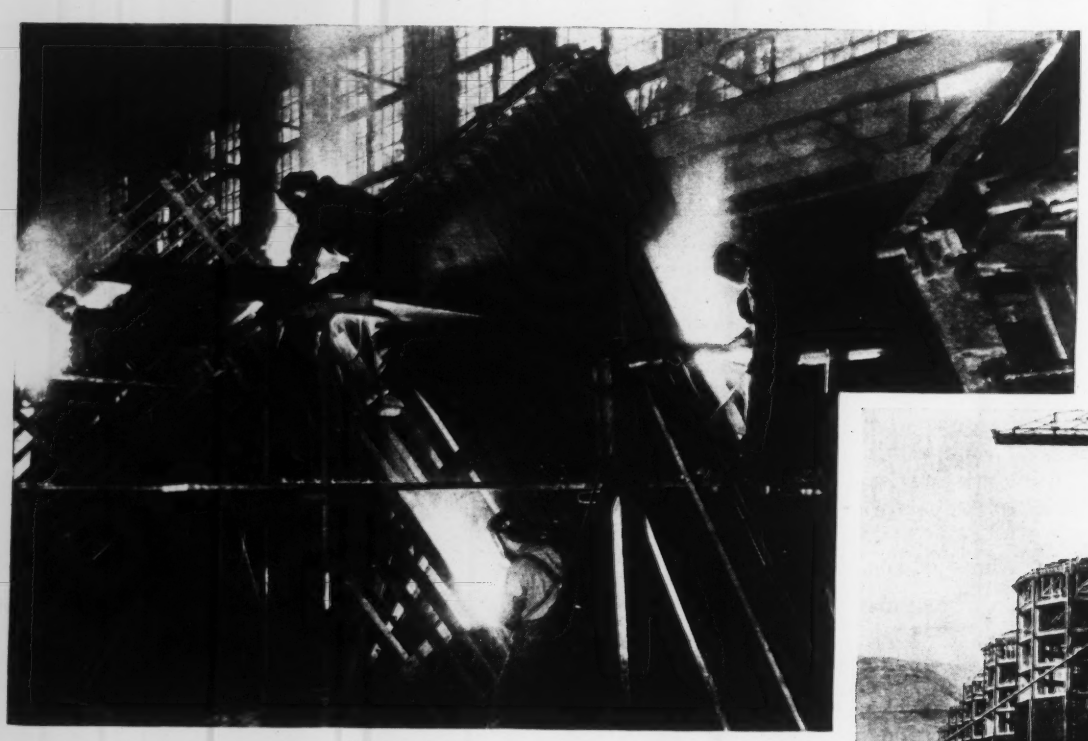
SPECIAL INTEREST attaches to the federal government's recent call for bids on cement for two quite distinct reasons. First, prices are to be named at mill instead of at delivery point, which threatens to upset established marketing practice. Second, the proposed purchase contracts are unworkably one-sided.

Some months ago the Federal Trade Commission began a trial to determine whether the sale of cement on the basis of prices prevailing at principal marketing points is collusive. The present call for mill-price bids may tend to prejudice the issue, and discussion of its merits therefore is hardly in order. However, the establishment of a new marketing method for the largest single customer, the government, may make it impossible to maintain the present marketing system for other buyers; the private buyer may then find himself under a bad handicap, as he would be unable to buy in the marketplace but must seek his supply at distant source points.

Of greater present importance, however, is the unworkable set of terms prescribed. The bidder is asked to name prices and take contracts for furnishing cement without assurance that he will actually sell a single barrel. He must take a contract that will require him to hold his bins full of tested cement and keep plant and man ready, and yet may be left without any orders. Production cost cannot be calculated on such a basis, and no prudent business man can determine a fair price. The call therefore is not a call to bid, but an invitation to enter a gamble against which even abnormally high prices would not protect.

From the standpoint of square dealing such one-sided contracts cannot be justified. They are unsound alike in principle and in effect. If hasty and slipshod drafting of the bid terms is responsible the call should be revoked. If deliberate intent to discard fair contract practices is involved, the matter deserves the attention of Congress.

PICTURES IN THE NEWS



WELDING FOR GRAND COULEE'S "BAY WINDOWS." Shown at right are a few of the 360 trash racks installed, and above is the welding operation. Bars were placed in jigs in the shop.

PROGRESS AT SAN FRANCISCO. Several of the timber exposition buildings are shown. In the foreground, framework for one of the main gate "elephant towers" is seen.

Mississippi Control Works Tested by Flood

by MAJOR GENERAL J. L. SCHLEY
Chief of Engineers, U. S. Army, Washington, D. C.

Unprecedented flood of 1937 put plans for controlling floods in the lower river to their first test and demonstrated the advantage of cutoffs

Following the disastrous flood of 1927 along the lower Mississippi River, Congress passed an act providing for a costly flood-control project including levee raising and straightening, and for floodway to carry excess water that could not be carried in a major flood. The flood of last spring surpassed in quantity of water the maximum flood for which provision was made under the 1928 flood-control project. Thus it put the nearly completed system of protective work to an abnormal test. In the following article General Schley points out how well the system stood the tests and notes some minor weaknesses. — EDITOR.

TORRENTIAL RAINS were falling in the Ohio Valley throughout January 1937, and to those living there it seemed that the peculiar atmospheric conditions that were producing the unusual rainfall would never change. Higher and higher crept the Ohio River until it reached stages from Point Pleasant, West Va., to Cairo, Ill., greater than ever before recorded, drove more than 500,000 persons from their homes, and caused damages estimated at more than $400,000,000. Eventually the rainfall ceased. The Ohio flood was poured into the Mississippi and passed on to the Gulf. Rivers returned to their banks and engineers to their study of the great mass of scientific information obtained and to a searching analysis of this flood and the manner in which the engineering structures designed for its control had functioned under the test.

In much of the Ohio Valley the flood waters did their damage at will wherever man had encroached on the flood plain of the river, whether it be a humble farm near Evansville or a great hotel in Louisville.

Floodways tested

The Birds Point-New Madrid Floodway across the river and near Cairo was opened to flood waters by blasting the front line levee when a stage of about 53.1 ft. was reached on the Cairo gage on Jan. 25, 1937, after natural crevasses into the floodway farther down stream had started in the vicinity of Crosno, Missouri, and Copp Cypress. The flood waters overtopped, crevassed and scoured the river front levees in many places and inundated the entire floodway which at the crest of 59.51 ft. at Cairo was carrying approximately one-fourth, or about 500,000 sec.-ft., of the entire flood flow of the river.

After the January-February rise, all of the openings except near River-Mile 49 and in the lower fuse-plug section were closed by interim levees under repair contracts or by emergency work of sufficient magnitude to prevent head water flooding from the rise of May 1937.

The Birds Point-New Madrid floodway made it possible to save from overflow the walls and levees around the City of Cairo, at the junction of the Ohio and Mississippi rivers, where the water reached heights, at a few points, greater than the top of

Fig. 1. **Crest of the flood at Arkansas City. The effect of cutoffs is evident here as the levee still is at the 1914 grade.**

Fig. 2. **Thirteen cutoffs now operating along the river have shortened the river 115 miles and have lowered the flood plane considerably.**

the wall and levees. Between Cairo and the mouth of White River the new levees held without a single crevasse in the main levee line and passed on to the lower river a flood which, above the mouth of the White River had reached greater heights than ever before experienced.

Between the Arkansas and the Red River the improved levee system and a river channel improved by cut-offs and other channel work carried, at stages generally lower than those recorded in 1927, a peak rate of flow greater than ever before carried to the Gulf between levees. No breaks in levees occurred and no water was spilled over relief levees, into floodways or backwater areas. Below Red River the Atchafalaya River carried its quota of the great flood without the use of either of the so-called Atchafalaya Basin floodways.

The main Mississippi past New Orleans was relieved of a portion of its flow by diversion through control gates at the Bonnet Carre spillway. The essential facts concerning the operation of the Bonnet Carre spillway are briefly as follows:—

The Bonnet Carre spillway and floodway, located from Mile 941.5 to 943.2 approximately 33 miles above New Orleans, La., was designed to divert a maximum discharge of 250,000 sec.-ft. from the Mississippi River into Lake Pontchartrain. Gradual opening of the spillway bays was begun on Jan. 28, 1937, with a stage of 14.1 ft. on the Carrollton, La. (New Orleans), gage and was continued until Feb. 18, at which time 285 of the 350 bays were in operation. A maximum flow of approximately 211,000 sec.-ft. was observed on Feb. 25 with 285 bays in operation, with a stage of 19.0 ft. on the Carrollton gage. Gradual closing of the bays commenced on March 7, and was completed on March 16, 1937. The rate of opening the bays was planned so as to prevent the Carrollton gage exceeding 20 ft. The closing schedule attempted to diminish the daily weir discharge by an amount approximately equal to the decrease in river flow, and thus hold the Carrollton gage stationary.

Thus in the lower Mississippi Valley the project works tested were the improved levee system, the New Madrid floodway, the channel improvement between the Arkansas and Red rivers and the Bonnet Carre spillway. What do the records show as to the manner in which these various portions of the project measured up to their design function?

Broadly speaking, of course, the answer is simple and obvious. The greatest controlled flood in history was passed through the Mississippi River from Cairo to the Gulf without serious accident. The project works met the test of experience and protected a large area from damage by overflow.

Main levee system

Considering first the main river levee system in general, the increase in grade and cross section provided by the 1928 act greatly simplified the flood fighting problems. Local emergencies occurred—as they always will occur over 2,000 miles of levee line—and were solved—as they can always be solved by a capable organization. In some localities it was found that additional berms should be constructed to prevent sand boils and excessive seepage. In a few instances some local correction of grade line will be required. A few relocations of levee line will be necessary. However, the sum total of all of this reconditioning and minor revision of the main levee system is relatively small and can be accomplished in the normal progress of completing the Mississippi River levees.

Some adjustments of grade along the Bonnet Carre floodway levees below the spillway were shown desirable by the 1937 operation, but these are relatively minor.

A limited amount of scour occurred between the Illinois Central Railroad and Lake Pontchartrain, which was largely corrected during the 1937 construction season. The amount of lowering accomplished by the spillway on the Carrollton gage was approximately as computed under the 1928 project and no extensive revision of plans at this point are necessary. Some filling occurred in the upper portion of the floodway between the Airline Highway crossing and the weir.

As is always the case with respect to every improvement, the designs of which are based on the perpetually changing and progressively expanding data produced by nature, some improvements in the Mississippi River flood control project appear desirable in the light of the new experience of the 1937 flood. The flood control plans for the Mississippi River have always been practical plans and like all practical plans must be modified from time to time to conform to new information.

New flood estimates

The maximum predicted flood as modified by the information gained from the 1937 flood has been assumed for planning purposes to be 2,600,000 sec.-ft. of run-off above Cairo, Ill., and over 3,000,000 sec.-ft. below the mouth of the Arkansas River. Of course these run-offs are less than the summation of the maximum recorded flows of all tributaries but they are greater than any summation of flows that have ever synchronized thus far. These predicted or project flows appear to be reasonable and practical bases for plans. In the formulation of plans it can be assumed roughly that the Mississippi River carries 1,000,000 sec.-ft. below its banks, 2,000,000 sec.-ft. below its levee tops, and that the other 1,000,000 sec.-ft. should be restrained from or diverted from the leveed channel in order to insure safety to the controlling levee lines.

The modified flood control plan presented by the Chief of Engineers in his report of April 6, 1937 (printed in Committee Document No. 1, 75th Congress, 1st Session) contemplated that the run-off of 2,600,000 sec.-ft. above Cairo would be reduced by reservoirs to 2,260,000 sec.-ft. at Cairo and that this flow could be carried safely in an improved channel between main river levees from below Cairo to the mouth of the Arkansas River. In the vicinity of Cairo where 2,000,000 sec.-ft. reached the top of the wall in 1937, some improvements were contemplated in addition to the improvement of the channel below.

Fig. 3. Cairo, Ill., was saved from submergence by emergency work on the levee.

At times of great floods the City of Cairo is subject to sand boils. Whatever the cause of these boils, their seriousness is increased by increase of flood stages. They attracted considerable attention during the 1937 flood; in fact so much attention in the popular press that even the laymen were much concerned about them. A diver working to stop a sand boil during the height of the flood called up through his speaking tube when he was first lowered into the water that his wife had just written him a letter asking him to be careful not to catch a case of sand boils. The alleviation of Cairo's sand boil trouble is to be found in the lowering of flood stages there. By lowering flood stages, the difficulties experienced during the past flood in the upper river can also be lessened.

Studies of the behavior of the river at Cairo since 1912 indicate that there has been a material increase in flood heights there. Records give gage-discharge relations as follows: In 1912, gage 53.9, discharge 2,000,000 sec.-ft.; in 1913, gage 54.7, discharge 2,000,000; in 1916, gage 53.2, discharge 1,780,000; in 1922, gage 53.6, discharge 1,500,000; in 1927, gage 56.4, discharge 1,630,000; in 1929, gage 52.6, discharge 1,630,000; in 1937, gage 59.5, discharge 2,010,000 sec.-ft. Facing these records and knowing the effects of the program to accomplish channel improvement and reduction of flood heights in the section of river below the Arkansas River it appears desirable that a similar program should be initiated in the upper river. Estimates of the effects of various improvements that might be made are encouraging and a program of lowering flood stages by increasing flood channel capacity in this reach of the river is being initiated. Additional levee protection for the vicinity of Cairo is also necessary.

It was recognized in preparing the flood control plan for the Mississippi River adopted by the Act of 1928 that the most difficult problems were in the reach between the Arkansas and Red rivers. Through this section of the valley there must be carried not only the great floods from the Ohio and upper Mississippi but provision must be made for the possibility of an Arkansas River flood so adding to the flood wave of the upper river that disastrous overflow would result.

The 1928 act provided that a section of the levee below Arkansas River would be left at a lower grade than the remainder of the system and great floods would overtop this levee.

To restrict the area overflowed by such floods a system of protection levees in the Boeuf Basin was proposed, extending from near the Arkansas River to the Red River backwater. Due to local opposition, this portion of the flood control plan was never carried out nor had it been possible to begin construction on an alternate by-pass in the same reach authorized by the more recent flood control act of 1936. Although conditions had prevented this portion of the flood control project from being completed, the Engineer Department between 1932 and 1937 did carry out an extensive program of channel improvement in this middle section of the river with a view to increasing the flow that the levee system might carry without increasing flood stages. A series of eleven cutoffs, as shown in Table I, was made between 1933 and 1936, which with the natural cutoff at Yucatan made in the fall of 1929, shortened the river approximately 100 miles. In this way 39 miles of the cutoffs were substituted for 140 miles of river bends around which the total fall was about 40 ft. on the 1929 high water profile. Following the 1937 flood an additional cutoff at Caulk Neck, shown in Table I, added 15.2 miles to the net shortening in this reach of the river. Locations of all cutoffs are shown on map, Fig. 2.

Flood crests lowered

Throughout the central portion of the river the effect of cutoffs and lowering of flood plain was considerable. At Arkansas City for rising stages above 45 ft. the discharge ranged from 500,000 to 700,000 sec.-ft. in excess of that carried at the same stage in 1929. Below the Greenville Bends the 1937 crest was about 1 ft. below that of 1929 although the flow was about 20 percent greater. At Vicksburg the rising branch of the rating curve showed an improvement in carrying capacity since 1929 of about 370,000 sec.-ft. for stages above 45 ft.

Between the Arkansas and Red rivers levees were not threatened at any point. A small amount of topping was done to increase freeboard. As a result minimum freeboard in the district was 6 ft. at the crest of the flood ranging up to 12 ft. throughout a considerable part of the district.

The 1937 flood demonstrated an increased carrying capacity at every point on the river within the influence of the cutoffs and related works, that is, from shortly above the mouth of the White River to below Natchez. A comparison of the 1937 and 1929 floods indicates that gage heights of equivalent discharges were lower in 1937 by some 10 ft. at Arkansas City and by from 4 to 5 ft. at Vicksburg. Experiments and analyses made by the Vicksburg Waterways Experiment Station in 1932, estimated reductions to be expected from proposed cutoffs at over 9 ft. for Arkansas City and at about 2 ft. for Vicksburg. The results of cutoffs as indicated by the 1937 flood were therefore more favorable than the estimates made in advance. At Natchez, the 1937 gage rose 1.1 ft. higher than heretofore recorded, but the river in 1937 carried past Natchez a confined flood greater

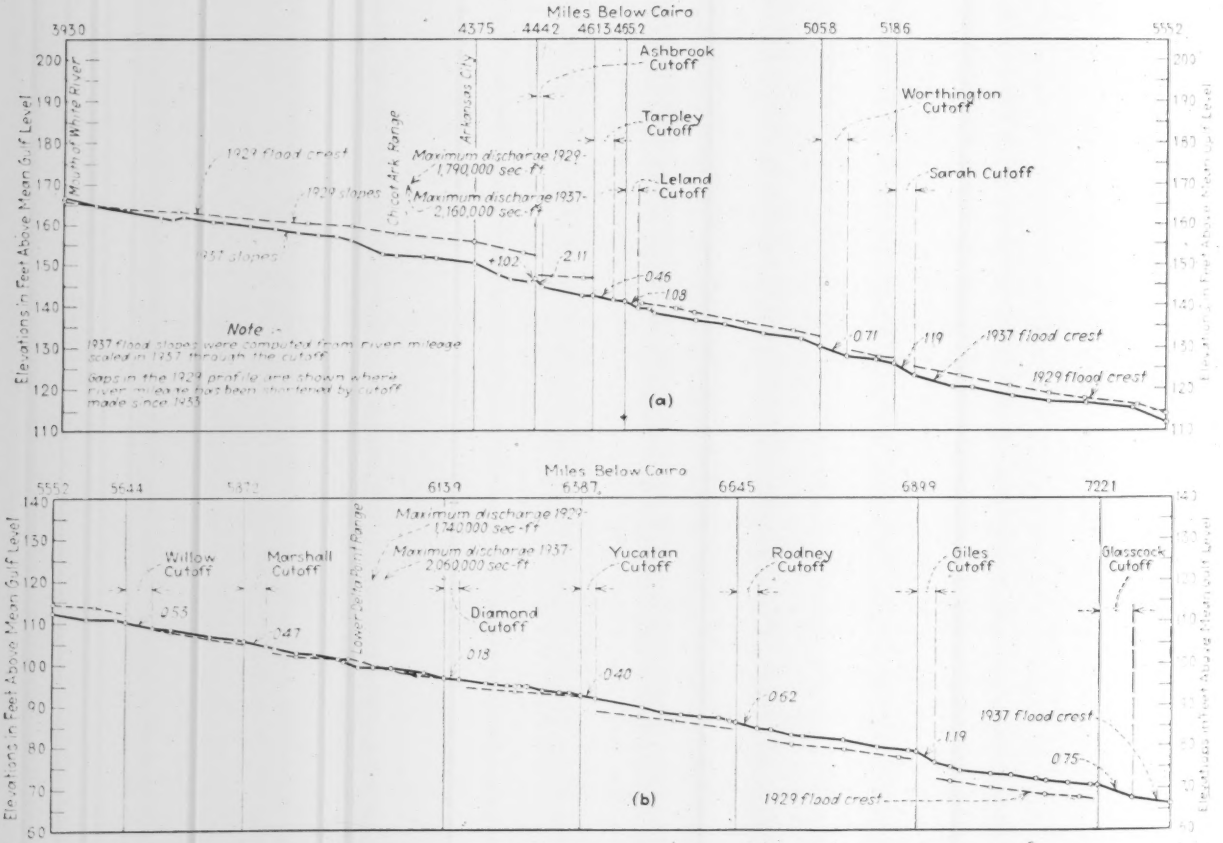


Fig. 4. The effect of the cutoffs on flood crests is shown in this profile of the river in the 1929 and 1937 floods. Slopes through some cutoffs still are affected by channel restrictions as the cutoffs have not attained full section.

TABLE I — MISSISSIPPI RIVER CUTOFFS, ARKANSAS RIVER TO RED RIVER LANDING, MADE SINCE 1929

Mileages and distances refer to center line of bank-full river

Name of cutoff	Date opened	Location by river mileage (a)	Distance as of date of opening cutoff			Length of dredged cut	Fall across neck		Maximum discharge February 1937
			Across neck	Around bend	Net shortening		At high water 1929	At mean low water (b)	
			Miles	*Miles*	*Miles*	*Feet*	*Feet*	*Feet*	*Second-ft.*
Caulk	May 13, 1937	406.1–421.8	2.0	17.2	15.2	4,400	(c) 2.9	(d) 5.8	
Ashbrook	November 19, 1935	443.9–456.4	1.9	13.3	11.4	4,530	5.4	2.8	1,810
Tarpley	April 21, 1935	461.2–472.2	3.6	12.2	8.6	13,000	1.8	3.4	1,340
Leland	July 8, 1933	472.2–483.5	1.4	11.2	9.8	3,900	4.3	3.4	2,160
Worthington	December 25, 1933	505.7–513.3	3.8	8.1	4.3	17,600	3.7	1.6	787
Sarah	March 23, 1936	518.3–526.4	3.2	8.5	5.3	12,600	2.2	3.0	550
Willow	April 8, 1934	564.0–578.0	4.7	12.4	7.7	22,000	4.0	3.7	1,100
Marshall	March 12, 1934	587.0–593.0	3.1	7.3	4.2	13,600	2.4	2.2	940
Diamond	January 8, 1933	613.6–626.0	2.6	14.6	12.0	9,175	2.2	4.2	984
Yucatan	Fall of 1929	638.3–648.0	2.6	12.2	9.6	11,000	3.7	2.8	1,290
Rodney	February 29, 1936	663.7–672.2	4.1	9.9	5.8	13,000	2.7	2.0	264
Giles	May 25, 1933	689.5–704.1	2.9	14.0	11.1	10,000	4.6	2.8	702
Glasscock	March 26, 1933	722.5–736.7	4.8	15.6	10.8	20,800	3.2	3.4	376
		Totals	40.7	156.5	(e) 115.8	155,605	43.1	41.1	

(a) Below Cairo, Ill., 1913–1916 survey mileage.
(b) As of date of opening cutoff.
(c) 1937 high water fall — 4.7 ft.
(d) Actual fall on August 28, 1936 — 10.6 ft., at low water.
(e) Total shortening 115.8 miles in 330.6 miles of river.
Reproduced from "Stages and Discharge Observations, Lower Valley of the Mississippi River, Jan. 1–June 30, 1937."

than ever before. There was no direct measurement of the volume of the 1929 flood at Natchez, but the indicated lowering of the gage at Natchez for comparable confined floods is estimated as from 1 to 2 ft. Profile, Fig. 4, shows the flow line of the 1937 flood crest as compared to the 1929 throughout the reach of the river from the mouth of Arkansas River to below Glasscock Cut-off.

Flood characteristics vary

It is a well known fact that different floods flow down the Mississippi River with different stage-discharge relations. For example, at Arkansas City these relations have been: In 1912, gage 55, discharge 2,000,000 sec.-ft.; in 1913 gage 55, discharge 1,780,000; in 1916, gage 56.4, discharge 1,890,000; in 1922, gage 56.0, discharge 1,760,000; in 1927, gage 59.3, discharge 1,710,000; in 1929, gage 58.5, discharge 1,830,000; in 1937 gage 53.7, discharge 2,160,000. Prior to 1929 most of the discharges given were effected by crevasses. Without the increase in capacity obtained by the cutoffs and channel improvements, the 1937 flood stages would probably have exceeded the top of the levees at the head of the Boeuf Basin.

There has been some discussion in the technical press and at other places regarding the variations in improvements in channel capacity. These variations result from the differences in falls or slopes produced by the various cutoffs. The fact that the Natchez gage was higher in 1937 than in 1927 does not prove that there was an increase in the stage below certain cutoffs. It is a fact that Natchez is below all but one of the cutoffs and that the stage was slightly higher than in 1927. However, this fact and the additional knowledge that the one cutoff below Natchez was only partially developed explains the reason for much less lowering at Natchez than at upstream points. The 1928 project contemplated the highest possible stage for a flow of 1,950,000 sec.-ft. at Natchez. In 1937 approximately 2,000,000 sec.-ft. were carried by Natchez at a stage lower than that assumed in the 1928 act for the purpose of determining safe levee grades. Stages at Natchez were not raised by the cutoffs but merely were *not lowered* as much as stages were lowered at certain upstream points. At Vicksburg the lowering was about one-half that at Arkansas City which is consistent with the fact that the cutoffs below Vicksburg increased the fall or slope of the river much less than the three major cutoffs immediately below Arkansas City. The stage lowering produced by a cutoff depends upon the relative amount of improvement in slope accomplished at and below the point considered.

Middle river conditions

The functioning of the project in the middle river is discussed at length because in this stretch the difficulties to be surmounted are greatest. The cutoff improvements there have given results more favorable than estimates made in advance, and have definitely been successful in lowering flood stages even though this lowering is not sufficient to warrant the hope that the maximum predicted flood can ever be carried entirely between main river levees. No effort should be spared to lower flood stages wherever, whenever and as much as practicable, but diversion floodways are necessary for the Mississippi River below the mouth of the Arkansas in order to carry within the main-river and floodway levees the maximum predicted flood and to protect the lower part of the alluvial valley safely against such a flood.

Results satisfactory

Looking backward at the 1937 flood it is seen that those flood control works which performed their designed tasks, and even exceeded expectations in some cases, have been a little dimmed in the public eye by the distress so evident in unprotected areas. Danger and distress make news. Safety does not. The story would have been very different if the work recently done in the valley had not been done. Summarizing the experience of the 1937 flood, it may be stated that the control works, as completed to date, performed their assigned parts, some better than anticipated, some perhaps not quite so well, but all well enough to have accomplished what was required of them. They saved the valley from what would otherwise have been the disaster of 1937.

Reading Weir Elevations By Automatic Telegraphy

by D. D. Gross
Chief Engineer, Municipal Water Commission, Denver, Colo.

Remote reading eliminates need for trips over rough country around Denver water supply reservoir

Lake Cheesmann, the famous reservoir which holds the reserve water supply for Denver, Colo., is located in the mountains 60 miles from the city. The bed of the reservoir is formed by narrow mountain canyons, traversed by the South Fork of the South Platte River and Goose Creek. State laws require the maintenance of measuring weirs at the points where these streams enter the reservoir. No roads lead upstream to these weirs and it is necessary to use a boat in order to visit them. When the water has been drawn down a considerable distance, as frequently occurs, it is necessary to supplement the boat trip by a long walk and climb over the mountainsides.

Herman DeKoevend, the caretaker of the reservoir, has devised a signal device by which the amount of the inflow can be learned in his office without the necessity of a 5-mile trip to the weir, except at long intervals when charts are changed.

A distant indicating device has for several years been in use below the outlet of the dam which made it possible to tell the discharge through the valves as measured over a weir located 1,000 ft. below the dam, without the necessity of the operator making a trip from the valve house through the tunnels and over the mountainside. This indicator has proved very useful and satisfactory but it requires both power and considerable wiring. The new device has been designed to eliminate these requirements. It consists of five essential parts as follows: First, a float; second, a carriage mounted over the third item, a water-motor-driven drum; on the carriage is mounted the fourth item, a transmitter; the fifth item is a single telephone wire stretched along the fence line from the wire to the caretaker's office.

The float is mounted in the well similar to the float on the recording gage. This float, operating against a counterbalance, drives the carriage back and forth on its mounting above the drum in accordance with the height of the water in the stilling well. The drum is larger than those used on the ordinary recording gage device but is somewhat similarly mounted, except that in the ordinary gage the drum is driven by clockwork, and in this device the drum is driven by a small water turbine. The whole device is so mounted that water can be piped from above the weir for the purpose of turning the wheel and revolving the drum.

Longitudinally and circumferentially about the drum are mounted a series of lugs, arranged according to definite plan. This arrangement of drum and lug is a peculiar and original part of this device; it is the part of the device that originates the dots and dashes by which the signal may be read. The transmitter mounted on the carriage consists of a phonograph transmitter and telephone transmitter, so combined that the needle contacts the lugs as the drum revolves, making the dots and dashes which are sent through the transmitter over the telephone wire to the office. As the water rises and falls in the stilling well the float and counterweight move the carriage of the transmitter back and forth along the track above the revolving drum, thus the phonograph needle contacts a different system of lugs for each different position of the float.

By this device the signal can give a reading to the nearest hundredth of a foot. Telephones are mounted at both ends of the line. On placing the signal in service a switch is thrown, cutting out the telephone and connecting the transmitter of the signal system to the telephone line at the weir. Whenever the caretaker wishes to listen in on the signals he throws a switch in his office, connecting his telephone to the signal line. Between the signals there is a period of silence for ½ min., then the signal is repeated. The instrument continues

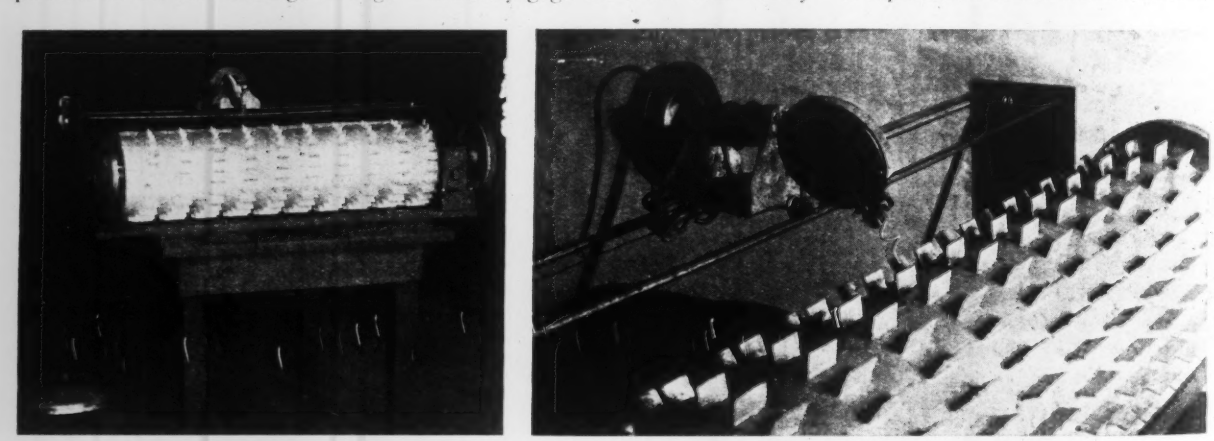


Fig. 1. The weir reading transmitter is a water-motor-driven drum studded with lugs which impinge on a needle attached to a movable combined phonograph and telephone transmitter.

to repeat the signal so long as the telephone is connected.

Since there are two inlets, and it is desirable to have signals from both weirs, a switch operated by a clock is inserted in the line. The clock throws a switch every half hour; during one period the reading from the weir on the South Platte may be heard, during the second period the reading on the Goose Creek weir may be received. No power lines are required to operate this signal. The float, of course, is actuated by the rise and fall of water in the stilling well. The drum is revolved by the small water turbine, which can be regulated to any desired speed to give a signal that can be readily understood over the telephone. The message sent over the telephone wire uses the same dry cells used in operating the telephone line.

This instrument can be adjusted to measure any depth of water over the weir. With a single direct connection, that is one pulley threaded on the cable between the float-and-transmission device, the equipment will give information on a water depth equivalent to the length of the cylinder. Should the anticipated maximum depth be greater than the length of the cylinder the required additional number of pulleys are threaded on the float cable when the instrument is installed.

The above description applies to the equipment when used as an audible signal. It has also been used as a recording signal by substituting modified telegraph instruments in lieu of the telephone instruments used in the Denver installation; a paper tape being used to receive the record on the receiving device at the caretaker's office. Mr. DeKoevend is applying for a patent on that part of the automatic transmitting device which is new and original.

Railroad Bridge Built Of Two 108-ton Precast Slabs

by Robert S. Johnson

Senior Highway Bridge Engineer, U. S. Bureau of Public Roads, Albany, N. Y.

Locomotive cranes install bridge superstructure in 24 hours without interrupting train movements

Building a railroad bridge superstructure away from the bridge site and later lifting it to its final position was the unusual procedure used on the Canadian National Railways' grade separation project on New Hampshire state highway route No. 110 near Groveton. The superstructure, consisting of two 108-ton precast reinforced concrete slabs was moved into place on November 14, 1937, by two locomotive cranes without interrupting train movements. Although variations of this method of construction have been used rather widely on railroad and bridge work, the weights handled on the Groveton job were uncommonly large.

Since a great deal of freight is carried over this Montreal-Portland line of the Canadian National Railways during the winter season when Montreal Harbor is icebound, it was desirable to have the new bridge in complete service before severe cold weather. To save the time required to build the superstructure after the completion of the substructure, as in the ordinary bridge it was decided to precast the superstructure slab while the substructure work was in progress. Thus, with the tracks carried across the bridge opening on a timber trestle, and while the abutments were being built, the reinforced concrete slab was being precast on a suitable platform alongside the tracks at a point about 200 ft. west of the bridge site.

The bridge was designed for a single-track Cooper E-60 loading and to fit a square opening of 32 ft. on a 45-deg. skew. The rails rest directly on tie plates attached to the concrete slab and are held in place by clips. A guard angle is attached to the slab by bolts cast in place. The overall length of the slab along the centerline is 60½ ft., the depth is 3½ ft. and the width 13 ft.

The slab, in two 108-ton sections with a longitudinal center joint, was constructed on the platform one section at a time in the same manner as if it were actually being built in place. This allowed perfect matching

Fig. 1. Cranes picking one of the 108-ton slab sections from casting platform preparatory to moving to the bridge site.

Fig. 2. Bridge superstructure as cast, at left, and, at right, supported on temporary platforms out-side its final location.

of the units in their final position in the bridge structure. During casting, lifting stirrups, carefully spaced so that the sections would be in perfect balance when lifted, were built into the slabs. Concrete was vibrated during construction. The specified minimum strength was 3,000 lb. per sq.in., and test cylinders indicated an average strength of 3500 lb. in 28 days.

Prior to the slab moving operations, temporary platforms were built on each side of the trestle carrying the tracks across the bridge opening to receive the slab sections and support them while the trestle was being torn out. Moving operations started in the rain about 6:30 a.m. on Nov. 14. Two heavy railroad cranes were used, one of 150-tons and one of 120-tons capacity. Each end of the section nearest the track was secured to a crane by means of cable slings through the two lifting stirrups, the slings being hooked to balance beams hung from the crane booms. The initial lift of the crane broke the bond between the concrete slab and the platform on which it was built, and the slab section was then lifted and swung simultaneously by both cranes to a position between them. During this operation outriggers from each crane, securely locked in position, furnished the resistance to overturning.

The cranes were next moved to the bridge site where the outriggers were again put into position and blocked to allow the swinging of the slab from its position above the rails and over the bridge opening to the platform on one side. The cranes were then returned for the second section. This section was a greater distance from the tracks and because of the limited boom radius of the cranes it was necessary first to spot the cranes directly opposite the section, lift it and deposit it at a point close to the tracks. The cranes then moved apart leaving room enough to lift the section and swing it between them before moving to the bridge site. Blocking of the outriggers was necessary for each operation of each crane. Moving of this second section was concluded about 1:30 p.m. after which work was suspended to allow the passage of two trains, the last passed the bridge site at about 3:30 p.m.

Soon after 3:30 the cranes were moved to their positions, one at each end of the bridge, and dismantling of the trestle began. At the same time the bridge seats were prepared by spreading over them a thin layer of dry cement and covering this with zinc plates. Finally, the two slab sections were swung into their final positions and the lifting stirrups burned away. The rails were placed, and the bridge was ready for traffic about 8 p.m.

The bridge was designed by the Canadian National Railways and built by Baker & Co., Hyde Park, Mass. under a contract with the New Hampshire state highway department. The project is financed by the federal government through the U. S. Bureau of Public Roads. The resident engineer for the state was James H. Travis, and for the railroad Mr. Griffis, while the superintendent for the contractor was Emory V. Forrest.

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Tax Exemptions Prove Profitable For Cities and States

SAVINGS of many thousands of dollars are going into the treasuries of those cities and states taking exemptions from federal excise taxes on certain commodities purchased, reports the Municipal Finance Officers' Association. While many municipalities are still ignoring the privilege, granted originally in 1932, others have found it decidedly profitable to have a special check made on all purchases for possible tax exemption. San Francisco, for example, employs in its controller's department an audit clerk whose chief job is to check invoices for this purpose.

As written into the Federal Revenue Act of 1932, the exemption was granted on municipal purchases for "essential governmental functions," but only if purchases were made directly from the manufacturer. Through various amendments the exemption was broadened from time to time and by October 1, 1935, it applied to all articles bought for the "exclusive use of the municipality or political subdivision."

Articles frequently purchased by municipalities, on which the federal excise tax is levied, include: gasoline (tax 1c per gallon); lubricating oil (4c per gallon); tires (2½ per pound); inner tubes (4c per pound); trucks (2 per cent of the value); passenger cars and motorcycles (3 per cent of value); radios (5 per cent of value). Exemption has also been on the 1c per ton coal tax imposed by the Bituminous Coal Act of 1937, if the fuel is used for governmental functions, such as waterworks.

Cities secure the exemption from the dealer who sells them the goods by filing an exemption certificate. Taxes paid in error by states and local governments may be recovered up until four years have elapsed. The exemption is strictly applicable to purchases for governmental use.

FIG. 1. BRIGHT LINES OF HEADLIGHT REFLECTORS CLEARLY OUTLINE MICHIGAN ROAD AT NIGHT

First Reflectorized Highway

A seventy-mile Michigan trunk road is outlined for safer night driving by parallel lines of reflectors set on 3-ft. posts outside the shoulder

A PIONEER movement to bring clear route determination to heavily-traveled rural highways has been inaugurated by the Michigan department of highways. Last week 70 mi. of Grand River road between Detroit and Lansing was dedicated to safer night travel by putting in operation a system of roadside reflectors. These are not the familiar little cats-eye buttons irregularly located as warning and direction signs; they are reflectors of real size and unusual brilliancy arranged uniformly in height, spacing and distance from the pavement on both sides of the road. Position and precision of location are fundamental elements of design and the effectiveness of roadway delineation.

Exact location stressed

The guiding purpose of the reflector delineation is best shown visually. Fig. 1 is a night view of a section of the road as it appears from the driver's seat with the automobile headlights on and no other source of direct illumination. On roads of undivided pavement the reflectors are bi-directional (facing both directions of travel) but on dual roads with a dividing strip or parkway, the reflectors are mono-directional (facing one direction of travel). In both cases there is a line of reflectors on each side of the travelway, that is four lines on dual roads and two lines on single roads as shown by Fig. 1. In the present Michigan installation the length of four-line markers is 4.8 mi.

In all cases the markers are set uniformly 100 ft. apart along the road but are omitted at driveways and entrances and in most cases inside city limits. The location with respect to the pavement edge is normally 8 ft. outside but on wide 18-ft. shoulders the offset is increased to 10 ft. and in towns where used and where there are curbs it is decreased to 4 ft. In all cases the height of the center of the middle reflector is 3 ft. above the top edge of the pavement. This uniformity of spacing, location and height is an elemental factor in the directional purpose of the reflector markers.

One reflector is shown by Fig. 2. The post is a $1\frac{1}{4} \times 1\frac{1}{4} \times 9/64$ angle with an anchor, galvanized after fabrication and usually 6 ft. long. The reflector element sets on the post to which it is fastened by a key; no tools are required for installation or removal. The reflector holder is stamped from 12-gage sheet metal and is enameled yellow. The reflectors are moulded lucite, a synthetic resin product. They are set three in a vertical row; each is $1\frac{5}{8}$ in. in diameter with a slightly convex face and a prismatic back. The color is crystal and reflects white.

Installation is simple

On the Michigan work on which 6,900 markers were installed a crew set up 5 mi. of two lines of units in a 9-hr. day. A crew consisted of 12 men operating 4 hammers, 1 man setting reflector units and a driver operating a $1\frac{1}{2}$-ton truck. The posts were staked ahead by a survey party, and elevation was checked by line level and rules. A special 40-lb. slip hammer was used to drive the posts; a man with a special wrench held the post as it was being driven.

The installation cost was $23,000,

Fig. 2. Headlight reflector unit and installation crew at work on the trunk road from Detroit 70 mi. to Lansing.

and the average two-line equivalent cost was about $347 a mile; the cost per unit was $3.34. Of the total cost 86.7 per cent was for materials and 13.3 per cent was for installation.

Commenting on the work Murray D. Van Wagoner, state highway commissioner, says: "The state highway department plans to extend this program to additional trunkline mileage as funds will permit. There are about 400 mi. of trunkline highways in Michigan which, by reason of the volume and type of traffic they carry, are very suitable for this type installation. US-16 between Detroit and Lansing was first chosen not only because of these factors but also because we have completely modernized the road in the last four years."

The present installation was inaugurated by special ceremonies and an inspection trip on April 6 in which a number of visiting highway and automotive engineers and state officials participated.

Keystone Dam Spillway Model

by D. A. Buzzell

Central Nebraska Public Power & Irrigation Project, Hastings

In order to facilitate fabrication and erection of the 50,000 sec.-ft. "morning-glory" spillway now under construction for Keystone Dam in Nebraska a $\frac{1}{2}$ scale model shown here was constructed in wood.

The spillway is of reinforced concrete construction with a structural steel skeleton. The steel skeleton, which is self-supporting, serves as a guide and pattern for the concrete formwork and also supports the weight of the forms and green concrete. The morning glory is, briefly, a 318-ft. overflow weir turned into a circle 101 ft. in diameter at the crest and warped down into a 28½-ft. tube which turns through a 90 deg. angle at the ground line into the 800-ft. outlet tube passing under the dam. This outlet tube is extended through the elbow to form a temporary diversion tunnel to take care of river flow during construction. This extension will be plugged with concrete after the dam is completed.

The entire vertical structure will be enclosed in a reinforced concrete shell, shown partly cut away in the accompanying photograph. The space between this shell and the tube will be filled with lean concrete and river gravel to give the structure stability.

The greater part of the model was made of ¼ in. plywood cut out to patterns made from the shop drawings. No reinforcing bars are shown and the concrete beams and shell are painted white to distinguish them from the structural steel.

The prototype will be 101 ft. in diameter, 170 ft. high, and together with the outlet tube and stilling basin, will cost about $1,500,000. The twelve tractor gates regulating flow are operated by one rotating electric hoist.

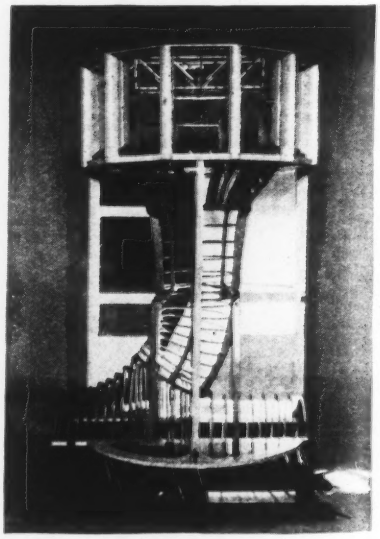

Fig. 1. This scale model of Keystone Dam morning-glory spillway was built for $100.

FIG. I. STANDARD FOUR LANES OF CONCRETE ON THE ROAD FROM PROVIDENCE TO NEWPORT, R. I.

Roadbuilding Around Cities

JOHN V. KIELEY

Chief Division of Roads and Bridges, Rhode Island Department of Public Works, Providence, R. I.

With strong demand for wide city bypass and access roads and scant highway funds Rhode Island is trying alternate strips of concrete and asphalt paving

Rhode Island has a particularly pressing problem of getting road transport out of and around its cities. Vacationists coming to the ocean and Narragansett Bay pleasure resorts want no interruption of congested city streets. People in these highly industrialized centers want to get out with their goods to near open ways for fast delivery abroad. Thus roadbuilding to shun congestion is the big highway problem of Rhode Island and is the theme of the article that follows. —EDITOR

IN COMMON with many other states in recent years, Rhode Island has been considerably restricted in carrying to completion necessary construction programs and projects due to lack of money for highway purposes. These programs today are not those of earlier days of original paving. Rather, they are programs of enlarging old paved roads to carry more and heavier traffic; of construction of a superhighway character to get through-traffic around centers of congested population, and their solution costs money—a lot of it. The illustrations here indicate some of the things being done and a description of them follows.

Three systems of roads

The total of all roads in the state is 2,680 mi. of which 772 mi. are state roads, constructed and maintained by the Division of Roads and Bridges. These roads are of three orders: (1) A trunk line system of highways which is intensively maintained in accordance with the best modern practice and reconstructed or modified at frequent intervals to follow the demands of ever-increasing speed and volume of traffic. This trunk or primary system is planned to provide for through-state traffic and to give access to the major centers of population and commerce of the state; (2) An extensive network of roads, which in its construction, is practically the same standard as the primary system and which serves as a bypass system for the thickly traveled metropolitan areas, and (3) radiating across the primary and the high-class secondary systems is another system of adequately paved and maintained highways which serve as access roads to the rural districts.

The highway work is a branch of a State Department of Public Works and is administered by a trained personnel under a chief of division. Finances are provided by an annual budget approved and allocated by the state's legislature from motor vehicle and gasoline tax receipts. In addition there are available any federal funds which may be allocated.

In Rhode Island there is the pressing problem of providing accessible, safe, and reasonably speedy means for motor transportation to move around and through highly-developed commercial and industrial centers and still be close enough to such

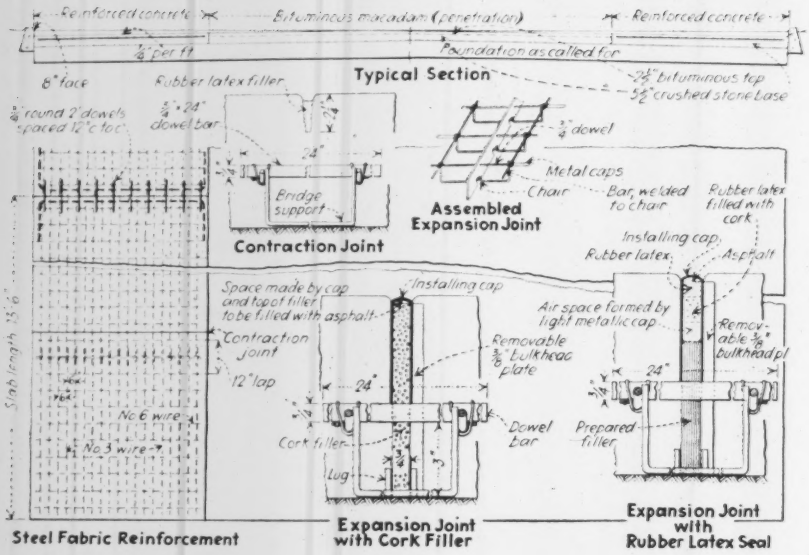

Fig. 2. The latest wide road design in Rhode Island combines concrete and bituminous surfacing. Note the joint details.

areas to enable traffic to reach them without too much loss of time. The solution of this problem demands careful and far-sighted planning to provide for present needs, and to foresee as far as possible the probable future trends and needs so that large investments may not be tied up in quickly obsolete structures. Therefore the division of highways now is, and for some time in the past has been, studying various plans and projects for the purpose of laying out, financing and constructing urban bypass and through routes lying close enough to the areas of heavy traffic to serve in the capacity outlined.

Legislative aids

Recent legislation as well as engineering study has been directed to this purpose. In line with modern ideas for trunk-line layout, the Rhode Island state legislature at its 1937 session passed a statute known as the "Freeway Act" enabling the division of highways to establish adequate right-of-way for certain highways which will be of limited access with divisional control over bordering, or fringe development. Rhode Island is among the first of the states actually to enact such a statute and it should be of great benefit in the establishment and policing of high-speed highways.

The right-of-way section also functions under a statute passed by the state legislature in 1921, giving the division of highways very broad and easily applied powers. Under its provisions the signing of a plat and description of the right-of-way desired and its filing with the proper municipal authority immediately conveys the fee in the land to the state for highway purposes. Settlements with claimants are made after taking and are not a perquisite to the taking, thus obviating any delay in acquiring the necessary right-of-way through preliminary negotiations or vexations and time-consuming arguments with uncooperative owners. The power of acquiring land is not limited strictly to right-of-way purposes, but may be exercised to acquire road materials and drainage areas. It is the policy of the division to acquire right-of-way whenever possible in widths sufficient to insure that future widening and development of the highways may be accomplished without additional taking when land values have risen along the newly constructed highway.

Design economies

In the design of four-lane roads for rural areas we have abandoned the typical 40-ft. concrete section, with curbs and sidewalks; at three locations in 1937 a dual pavement with two 10-ft. or 11-ft. strips of concrete separated by 25-ft. of bituminous macadam surface was used (Fig. 2). Outside of the concrete lanes we expect to continue the bituminous macadam for another 18 to 24 in. to protect the shoulders immediately adjacent to the concrete lanes. This design we hope will attract most of the traffic to the concrete, smooth, light-colored concrete lanes and will leave the dark central area for passing vehicles. The 25-ft. width will allow for two 11-ft. passing lanes and a neutral zone 3 ft. wide, defined by white traffic lines. Later, if the need is felt, this 3-ft. strip can be raised and a positive separating island installed. In the meantime some $7,000 per mile is saved by not installing a concrete separating island and this amount is used to get additional mileage. The fact that an average penetration macadam pavement costs about $1.20 per sq.yd., and concrete pavement about $2.20 per sq.yd. permits a considerable increase in width at very little additional cost.

In defense of this selection we have found by observation that traffic using a 40-ft. road of uniform color and crown habitually works to the center and thereby makes passing difficult unless the third lane is used, whereas on present dual-type traffic religiously holds to the outer concrete lanes. On these three trial sections it is hoped that traffic will automatically sort itself out into the proper lanes.

Another design which may be of some interest is the use of penetration macadam for the center 20-ft. width of a 40-ft. road serving a distinctly seaside development, the additional width of 10-ft. on each side of the penetration macadam being obtained by using so-called Topeka or gravel mix. This 2-in. surface was placed at a cost of $0.60 per sq.yd. The technique of placing the penetration macadam center first, with adequate sideboards for support, and then placing the Topeka alongside is now being worked out. It is expected that during the winter months the penetration macadam will take the bulk of the traffic, and possibly only this area will be plowed, whereas during the summer months the full 40-ft. width will be available for light motor traffic which alone uses the roads in this particular area. Again there was a saving in cost involved in the selection of this type. Rather rigid requirements for plant control have resulted in a very fine product being obtained from the Topeka specifications.

During the past year we have made several changes in our specifications which it is believed will give better construction than that obtained in the past. Base-course specifications in bituminous-macadam construction have been changed to include the application of water after the sand filler has been applied dry in several applications to the crushed stone or gravel in this 5½-in. course. It has been noticed that a base-course would become much more rigid and firm if subjected to a heavy rainfall after the sand filler had been applied and rolled dry into this course. Many times construction proceeded so rapidly that no rain fell between the time of sand filling and the application of the top or penetration course. By requiring the application of water in ample quantities the required puddling and density will now be obtained under all conditions.

In carrying out construction experiments on crack control in concrete bases for sheet-asphalt pavements we have been very much satisfied with results obtained in the past two or three years and find that practically all of the preformed joints act as desired in the design. The only improvement recently made is to add a requirement for vibration along the deformed metal plates which give the crack-control results; there has been some indication of honeycomb in the tongue-and-groove plates used to date and it is felt that a light vibrating unit will correct this condition.

One of the chief costs in shoulder maintenance is the renewal of surface treatments alongside the outside edges of two-lane concrete roads. In recent designs the gravel foundations have been carried out 10-ft. in several instances and a 2-in. pre-mixed surface applied to this area, using a mix of fine gravel and MC-3 or possibly RC-3 cutback asphalt in warm weather. In searching for a method to produce this mix, one contractor used a standard 21-E concrete mixer, with skip and bucket, and found that a mixture of about 20 gal. of hot MC-3 from a distributor to 1 cu.yd. of gravel produced a very acceptable mix which, when in place, had all the characteristics of a fine-graded bituminous-concrete hot mix. The material used was a dirty sand obtained as waste from a gravel plant which has been producing crushed gravel for bituminous-macadam base course. The small amount of loam and crusher dust available in this material furnished an acceptable amount of filler for the mix and the rubbery, resistant surface obtained promises many years of wear without retreatment.

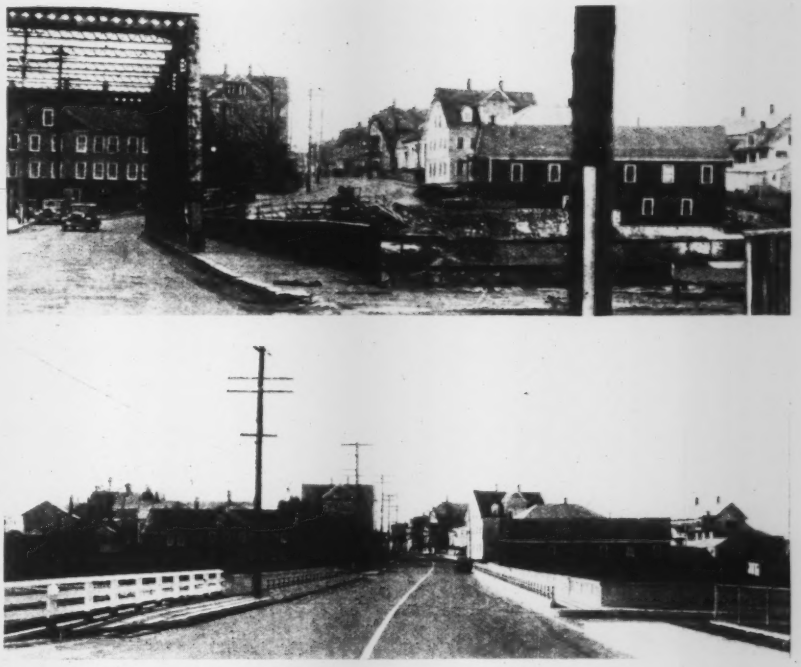

Fig. 3. An example of bridge revamping, before and after, at Warwick; the new bridge is a 120-ft. concrete arch 55-ft. wide and 38-ft. between curbs.

Fig. 4. Intersections are being opened up to vision as shown by this before and after view near Narragansett.

Methods of highway construction are in constant flux and standard practice for any one season may be outmoded the following year by new developments which are being constantly evolved through observation and research. No details are too

small to come in for their share of attention. One of the most troublesome, to mention only one, is the proper material and the practical installation of the transverse joint filling material in a concrete highway. This one question seemingly so unimportant to a layman has not yet been satisfactorily answered.

Contract work prevails

Practically all bridge and highway construction is by contract on the public-bid basis. The contractors are required to be bonded and must show a satisfactory financial, experience and equipment record before any work is awarded to them. This system has operated very well so far. Each contract or project is under the immediate supervision of a resident construction engineer who has the assistance of as many work and material inspectors as he needs. In this way every operation on the project is subject to constant supervision and criticism, not with a view to making trouble for the contractor, but with the idea of assisting him to obtain the best possible results and to cooperate with him in every way consistent with carrying out the intent of the specifications and obtaining the highest workmanship.

For the last two or three years it has been difficult to obtain the highly skilled hand labor in some vicinities which is necessary for some types of highway work, such as the laying and finishing of sheet asphalt and concrete pavement.

Maintenance extended

Highway maintenance is a major operation and the yearly increase in mileage results in a steadily increased cost for attention and upkeep. In Rhode Island particular efforts are devoted to the maintenance of the shoulders, especially the areas immediately adjacent to the pavement edges. This, in our opinion, is a very vital precaution in the interests of safety since the ruts developed by shoulder depressions next to the edges of pavements are extremely dangerous particularly on fast routes.

Maintenance covers a wide range of activities from the care given to the metallic surface to such details as supplying firewood for the public fireplaces. Policing the roadsides in the interest of sightliness and cleanliness is an activity seldom given much publicity, but its results are of great value in gaining favorable public opinion and adding to the attractiveness of the highways.

Great strides have been taken during the past two years in roadside development and beautification. Public parks and picnic groves have been established all over the state where fireplaces, tables, benches, good drinking water and firewood are provided free of charge for all who wish to use them. These areas have proved to be very popular, and during the season are always in use tourists and local automobilists.

The careful grading and seed[ing] of slopes and shoulders and [the] planting of intersection and [road]side areas with appropriate trees and shrubbery is receiving especial attention and worthwhile results have been achieved in reduced maintenance costs from wash and erosion.

Nurseries have been established where hardy shrubs and native trees and bushes are being cultivated to furnish reservoirs of material for future plantings.

Beam Shear Depends on Net Area

by E. H. MOUNT and C. B. WELCH
Research Fellow at Lehigh University, Bethlehem, Pa., and Assistant at Harvard University, Cambridge, Mass.

Comparative tests on short beams with no holes, open holes and plugged holes indicate that gross area does not govern shear strength or stiffness

IN THE DESIGN of steel beams and girders, shear is usually proportioned to gross web area. Such practice relies on the rivets to restore a drilled or punched web to its original condition, unless allowance for reduction in shearing strength is made by using a reduced working stress in shear. The ability of rivets to restore a drilled or punched web to its original strength in shear has not been justified by theory or experiment. On the other hand, reduced shearing stress unnecessarily penalizes webs with few holes. It was decided that an experimental investigation of the problem would be profitable.

Shear test procedure

Three test beams were used as the minimum number for satisfactory results. The dimensions and test set-up for the three beams are shown in Fig. 1. The web of Beam 1 had no reduction in area except for ¾-in. holes drilled for attachment of Huggenberger tensometers. Strain-gage holes 1/32-in. in diameter were drilled in the flanges. Beam 2 had three rows of five 1-in. holes drilled in each end of the web (see Fig. 1), in addition to holes for strain-gage and Huggenberger attachments as in Beam 1. Beam 3 was identical with Beam 2, except that the 1-in. holes in Beam 3 were filled with steel plugs ground to a driving fit, to duplicate the effect of rivets in replacing the shear value of the steel removed from the web, but without disturbance by any restraint due to rivet-head friction; that is, the method of plugging allowed observation of the effect of rivet shank alone.

Tests made to determine the properties of the steel used gave a yield point in tension of 37,500 p.s.i. for the web and edges of the flange and 32,500 p.s.i. for the center of the flange. An average elongation of 33 per cent occurred on a gage length of 4 in. The shearing yield point was determined as 23,000 p.s.i.

The three beams were tested in an 800,000-lb. Riehle machine. Strains were measured along the edges of both flanges with a 10-in. Whittemore strain gage reading to 1/10,000 in. Deflections of the beams were measured by a battery of five Ames dials attached as shown in Fig. 1. Throughout the investigation, these dials were used to check the uniformity of the set-up. An indication of unit shearing stresses in the web was obtained by measuring strains

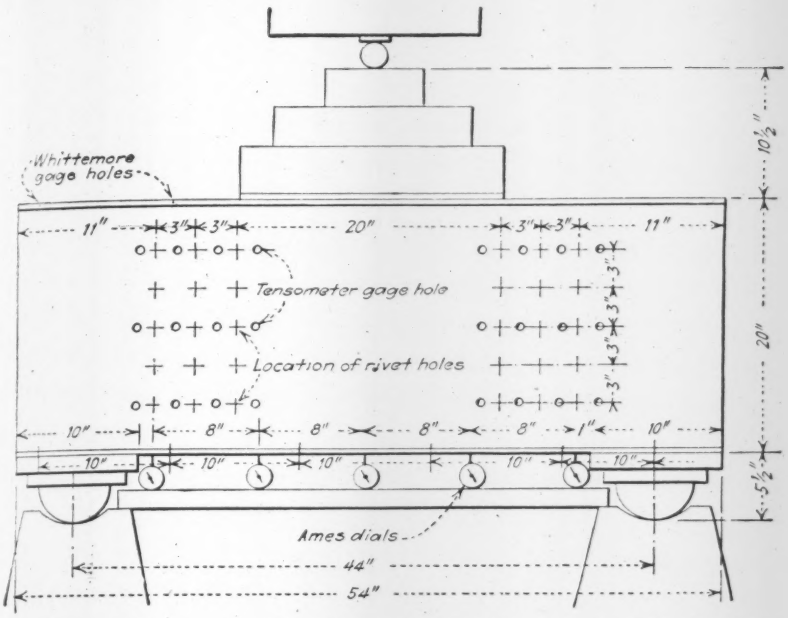

Fig. 1. Effect of open and plugged rivet holes on the shear resistance of a beam tested with short-span setup.

at an inclination of 45 deg., using Huggenberger tensometers attached at the points indicated in Fig. 1.

After measurements were completed for all points up to loads of 310,000 lb. on the solid beam and 210,000 lb. on each of the other two beams, the tensometers were removed and the beams were whitewashed. With the Ames dials attached to read deflection, the beams were then loaded until a definite yield occurred and clear Lüder lines developed. Increments of 10,000 lb. were used in this loading to failure.

Deflections increased by holes

In the solid beam the observed deflections agreed quite closely with the theoretical. In computing theoretical deflections, it was found that shear deflection ranged from 60 per cent of the total deflection at the center to about 35 per cent of the total deflection at the end.

In Beam 2 the reduced web area caused elastic deflections considerably greater than those observed for Beam 1, which had a solid web, and also considerably greater than the deflections calculated on the assumption of average shearing stress on a modified net area obtained by distributing the rivet holes in the form of a slot over the length of the reduced portion of the beam. The increase in deflection more nearly approximated the calculated increase in shear deflection based upon the average stress on the net area, assuming the net area to act over the entire length of the reduced portion.

Beam 3 showed that plugging the holes did not appreciably increase the stiffness of the beam until the yield point was reached. The effect of loading beyond the yield point on the three beams is shown in Fig. 2. The yield point for the beam with the drilled web (Beam 2) was 86 per cent of that for the solid beam, while the yield point for the beam with the plugged web (Beam 3) was 91 per cent of that with the solid web.

These results indicate that design for shear based upon gross web area is unsound. On the other hand, design based on uniform stress across the net section neglecting any increase in yield point caused by rivets is on the safe side.

The flexural stresses were almost unaffected by the presence of holes or plugs in the web. These stresses, as computed from the measured strain-gage results, checked quite closely the theoretical stresses based on an assumption of *uniform* load and simple support. Since arch action causes a considerable reduction in bending moment in short beams, such as those used in this program, the flange stresses obtained by the use of the flexure formula $(S = \frac{Mc}{I})$ were reduced 16 per cent. This finding indicates that reduction of web area has little influence on the effective moment of inertia of the beam, that is, on its flexural strength. The decreased strength and stiffness of the beam caused by reduced web area may therefore be charged to decreased shearing strength.

No attempt was made to compare the actual tensometer strains as measured in the web with theoretical values because of the complications due to direct compression. However, the measured strains give a good indication of *relative* shearing stresses. The increase in these strains due to web reduction was quite marked and generally regular. Filling the holes with plugs had only a slight effect on the web strains. The relative increase in web strain due to reduced web area was generally comparable to the increase in deflection.

The Lüder lines which appeared in the whitewash during the final test run show both vertical and horizontal shear slipping in the reduced portion of the web and indicate that failure was definitely the result of overstressing in shear.

Conclusions

The following conclusions are indicated.

1. Reduction of web area by rivet holes, within reasonable limits, has very little effect on the flexural strength of a beam.

2. Arch action in short beams re-

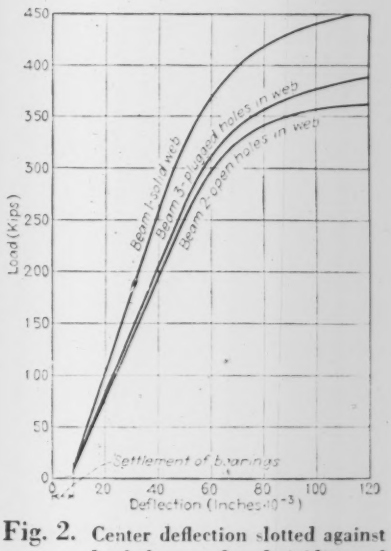

Fig. 2. Center deflection slotted against load shows reduced rigidity and strength in beams with either open or plugged holes.

duces the flexural stresses considerably below theoretical stresses based on the unmodified flexural formula.

3. The reduction of web area has considerable effect on the stiffness of a beam when shearing stresses are relatively high. Theoretical shear deflections based on average shearing stress over the net section, assuming the net section to act over the entire length of the reduced portion of the beam, are more nearly correct than those based on the modified net section.

4. Rivets filling web holes have no appreciable effect on the stiffness of a beam within the elastic limit.

5. Reduction of web area increases shearing stress in the web in about the same proportion that the average shearing stress increases over the net section. The distribution of shearing stress is also affected by a reduction of web area.

6. Rivets filling web holes have no appreciable effect on the magnitude or distribution of shearing stress in the web.

7. The working strength of a beam is considerably reduced by a reduction of web area. Although the flexural strength is only slightly affected, the shearing strength is proportional to the net section.

Some Arizona Engineering

Floods, dam-building and highway bridge operations engage interest at Phoenix, while at Yuma interest centers in Imperial Dam

THE BIGGEST ENGINEERING NEWS in Phoenix during March was the Verde River flood—what it did to the construction work at Bartlett Dam and what it would have done to Phoenix and the suburban town of Tempe if there had been the usual snow in the mountains to augment the streamflow. Without snow, the "rainwater" flood nevertheless lacked only 2 ft. more crest at Tempe to have crowded some of the Los Angeles flood news off the front page, according to informed engineering opinion.

At Bartlett Dam, 60 mi. north of Phoenix, the extreme hydrograph of record available to the designers showed 61,000 sec.-ft. peak flow. Last year in February the contractor experienced a 90,000 sec.-ft. flood, due to a combination of heavy melting snow in the mountains and a warm rain. The March 4 peak this year is estimated to have approached 120,000 sec-ft.; it was accurately measured on the Granite Reef overflow weir dam, 30 mi. downstream, as 92,700 sec.-ft.

It was an "impossible" flood; but the contractor at Bartlett Dam, who is building the highest multiple arch in the world (designed for the Salt River Valley Water Users Association by the Bureau of Reclamation) has conclusive proof that it happened. His 2-yd. concrete mixer is gone completely, one crawler of a 2-yd. dragling projects from the receded water below the dam, an upstream wall of his cofferdam is washed away, and steel forms for one of the arches lie twisted and bent in the debris that lodged on the structure. No damage was done the dam, whose river channel buttresses, poured to a height of about 100 ft. above foundation (ultimate height 270 ft.) were within 20 ft. of being submerged and whose arches, poured to a height of about 50 ft., were entirely under water.

Bartlett Dam is scheduled for completion about June, 1939. Granted freedom from another flood this spring, it is still believed the scheduled date will be met. Previous to the flood the contractor had averaged 400 yd. of concrete daily from November through February, using a double acting 8-in. concrete pump.

Turning to more normal happenings, the Arizona highway department is just completing a new west wing to its headquarters building in Phoenix. Of reinforced concrete and similar in design and appearance to the east wing built in 1931 and to the original building built in 1[illegible], the new addition is 56x60 ft. in plan and 2 stories high. It will provide more space for the engineering department and for the accounting and motor vehicle divisions. With the new addition the building has a total of some 30,000 sq.ft. of floor space.

Arizona highway bridge practice is not unduly different from that in other sections of the southwest. One design, however, that might have wide application on the score of economy concerns the usual small concrete multi-span girder-and-slab bridge. Arizona eliminates any abutments by cantilevering the end spans one-quarter of a span length. Since the cost of an abutment is usually about the same as the cost of a span on a bridge of this type, the saving by cantilevering is the cost of 1½ spans. The piers of such bridges are usually 5-pile bents.

The one large job occupying the Arizona engineers at present is the design of an underpass in Phoenix to carry South Central Ave. under 13 railroad tracks of the Southern Pacific and Santa Fe. Since four of these tracks must be kept in service during construction, a scheme has been devised to concrete the steel beams of the temporary trestle into the deck of the permanent rigid-frame bridge; no account will be taken of any strength that they may contribute. The estimated cost, all to be borne by the federal government, is $250,000. The city is to furnish the right-of-way and wants only a 24-ft. roadway in the underpass, which to an outsider seems false economy in view of the location on the main street of the city and the high cost of widening the structure, should this be required in the future.

On the the Salt River above Phoenix the alterations to the four irrigation and power dams—Roosevelt, Horse Mesa, Mormon Flat and Stewart Mountain—are practically complete. In general, the work, designed and supervised by the Bureau of Reclamation, consisted in enlarging the spillway or discharge capacities to carry their rated amount of water and improving the aprons and gates. Exacting and difficult, as repair or remodeling usually is, the

operations were also quite spectacular, since the dams are in deep, narrow canyons with the spillways high up on the face.

The visitor to Roosevelt Dam is always impressed by this fine old masonry structure, and the nearby ruins of the old cement-manufacturing plant, used during its construction, recall the fact that it was the Boulder Dam of a quarter century ago. Considering the state of the engineering art at that time, its construction represented a triumph that should not be forgotten.

When work started on Roosevelt Dam in 1906, the nearest rail head was 65 mi. away and mule team transportation over a mountain construction road was all that was available. Steam power had to be used at first; there was no coal, and wood was found only at great distances from the site. Electric power generation was in its infancy, but the builders (Louis C. Hill, recent president of the American Society of Civil Engineers, was construction engineer) went 20 mi. upstream, constructed a diversion dam and a canal passing through 22 tunnels to the damsite, and developed sufficient power to run the plant which turned out cement and to operate some of the construction equipment.

Between Phoenix and Yuma is the old Gillespie Dam on the Gila River, a multiple-arch structure about 25 ft. high. Two weeks after the flood caused by the record Verde discharge upstream, water was still flowing over the entire 1,000 ft. crest length of this structure. The curtain of water in front of each arch made a perfect reflecting screen for dozens of rainbows. Debris accumulations showed that the water must have been 6 ft. deep over this crest at flood peak, suggesting a truly remarkable sight.

At Yuma, the Imperial Dam and desilting works for All-American and Gila Canal diversions are rapidly nearing completion. Spread out over the flat river bottom, the project resembles a tremendous sewage treatment plant more than it does a diversion dam. Bureau of Reclamation engineers hope to turn the river through the permanent sluiceways before May 1, so as to complete work on the Gila Canal desilting basin and headworks.

On the All-American Canal, progress is also rapid, present operations concentrating on the power drops, wash overchutes and siphons. As soon as the outlet into the existing Imperial Canal at Pilot Knob, 20 mi. below Imperial Dam, is completed, Colorado River water will be turned into this section of the All-American Canal—perhaps before the end of the year. This water will not be desilted, since its purpose is to prime the canal bottom and siding.

March 19, 1938 Los Angeles W.G.B.

Lubrication for Water Meter Registers

CORROSION in water meter registers was a problem on the Los Angeles water system until a solution was found in the form of a special kind of grease and an effective means of getting the grease into place. Now meter registers are no longer a worry so far as lubrication is concerned, as one lubrication lasts until the meter comes into the shop for repair.

The first attack on the problem was to put in rubber bushings for spindle bearings in both top and bottom plates of the register. This helped, but did not prevent corrosion of pinion and spur gears, which is accelerated by the alternate wet and dry condition under which some of the meters must operate. Remedy of this part of the difficulty, it was decided, must be effected by greasing the gears. As meter registers on this system are equipped with a "dust ring," it was decided to use this ring as a retainer for the grease.

The next problem was to find a grease that would not become so hard in cold weather as to cause a drag on the gearing nor so soft in warm weather as to run or slump out. There were also the requirements that the grease should last well, should not be capable of emulsification with water and should be non-corrosive.

After considerable experiment a grease eventually was found which is said to be giving excellent service. The specifications are as follows:

Pale or neutral mineral oil, pour test not to exceed 150 deg. F.
Viscosity 400 sec. min. at 100 deg. F. (Saybolt Universal Test)
Aluminum soap—10.5 to 11.5 per cent
Melting point, 185 deg. to 195 deg. F.
Grease shall not emulsify in water and shall contain no free caustic or lime.

The problem of getting the grease into the register was solved by adapting to this purpose the grease gun developed for lubricating automobiles. The gun, as made up in the water department shop, consists of a short piece of 4-in. pipe mounted on

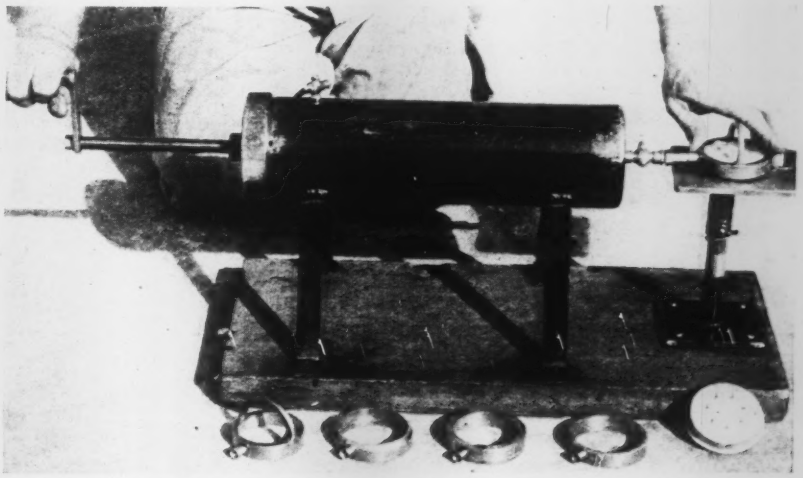

Fig. 1. A grease gun for lubricating meter registers.

short legs which are fastened to a board so that the gun will be portable, for convenient use on a workbench anywhere about the shop. The cylinder is mounted horizontally and is fitted on one end with a threaded cap through which a piston is operated by a hand crank. The piston puts pressure on the grease within the cylinder and the operator holds the meter register in a frame at the opposite end of the cylinder against a petcock. As it is necessary only occasionally to renew the pressure in the cylinder, the operator can use one hand for holding the register and the other for releasing the grease through the petcock into the register as desired.

Experience is necessary to enable the operator to judge how much grease to use for each register. The quantity should be sufficient only to completely surround the entire gearing between the top and bottom plates and the register casing ring. If much more is used it is apt to be forced through the spindle bearings in the register top plate and appear on the face of the register.

Due to the size of the cylinder it was found necessary to insert a petcock on top of the cylinder near the hand crank end and leave the petcock open to avoid forming a vacuum in back of the piston.

Considerable savings have resulted from the use of this grease and the gun because of the losses that have been stopped. In addition to (1) the revenue losses from meters that became too badly corroded to register properly, (2) the corrosion of registers called for costly cleaning and repairing and (3) much loss was entailed by the scrapping of those meters which are damaged beyond repair.

FROM FIELD AND OFFICE

Working problems and time-saving methods . . . Edited by Charles S. Hill

Pile Driver for Small Foundations

WM. J. KREBS
New Orleans, La.

A portable pile driver successfully used in small foundations for residential construction in New Orleans has an upright frame high enough to handle a 20-ft. pile, is mounted on a truck chassis and is powered with a gasoline engine. A 1,300-lb. hammer is used. The truck chassis is towed from one job to the other. On two jobs where the pile driver was used, the cost was $300 each with some offset rising from savings in other foundation work. Because of the type of soil in New Orleans, subsidence has presented a problem to builders of residences since unequal shifting of the foundation soil has resulted in the buildings dropping out of line. A recent soil survey indicates that piles ranging from 8 to 16 ft. are sufficient to reach strata of hard sand or clay; these strata, together with the friction resistance on the piling are more than sufficient to carry practically any residence structure. The load-bearing factor is from 5 to 10 times the estimated weight of the building so as to provide an ample safety factor.

$3 to $5
paid on acceptance for items suitable for the pages of From Field and Office

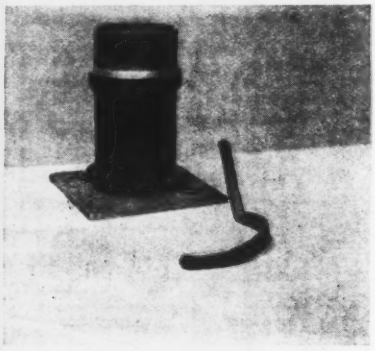

Fig. 1. Split mold for soil samples is shop made from a 4-in. pipe.

Five Laboratory Aids

F. V. REAGEL
Engineer of Materials,
Missouri Highway Department,
Jefferson City, Mo.

Ingenuity appears inherent in the laboratory worker. At least if inventiveness is not born in him he soon develops it in his testing and research work. In fact for many tasks he must invent his own mechanical aids. The reason is that despite prolific output of testing machines and laboratory devices these are limited to such as have a commercial market and testing and research often call for modification and rearrangement of marketed apparatus and sometimes for apparatus that is not commercially produced. In this case the laboratory worker has to devise and make the thing he needs.

This original work has been done on many occasions in the laboratories of the Missouri state highway department and it is thought that a number of the devices produced have a general usefulness that warrants description; this is given here with credit to the worker responsible for the device.

Soil Test Cylinder: W. E. Pugsley, Senior Engineer—Difficulty in removing soil from compaction test cylinders so as to remix it with added water as the water content is varied has been overcome by the shop-made split cylinder illustrated. The original cylinder was cut out of a solid casting and then turned down on a lathe. This proved very costly so splitting a 4 in. iron pipe was tried. To get a perfect circle it was necessary to split the pipe off center the width of the saw blade and throw one part away. By splitting two pieces of pipe one perfect cylinder can be made. Some difficulty was experienced in unscrewing the top ring; a wrench was made as illustrated out of ½-in. rod which fits into a hole drilled in the ring.

Capping Test Cylinders: C. Keane, Junior Engineer—The capping device for 6x12-in. test cylinders of concrete that is illustrated by the accompanying sketch gives a specimen with absolutely parallel ends perpendicular to the axis of the cylinder. The bottom cap is finished by the base plate and the top cap by a glass plate pressed flush with the rim top of the upper metal cylinder. When the capping is completed the test cylinder is removed resting on the base plate. Essential details are indicated by the sketch.

Measuring Slab Thickness: O. S.

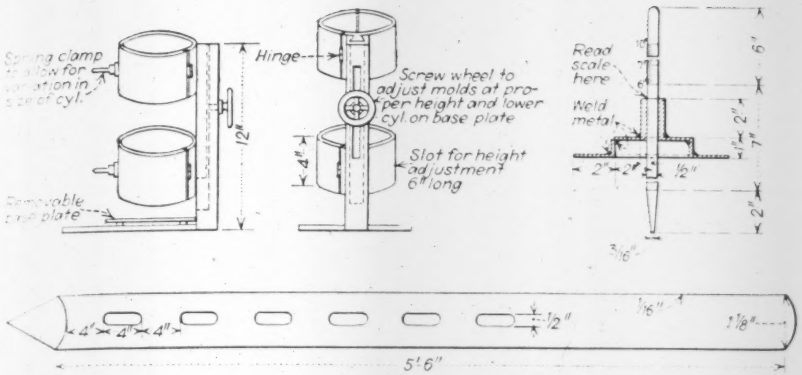

Fig. 2. (Upper left) Test cylinder capping device that caps both ends at the same time. (Upper right) Punch scale for measuring thickness of newly laid concrete slab. (Lower) Tube pushed in and rotated secures true samples of cement in bulk.

Axon, Junior Engineer—A useful device that has been used in measuring the thickness of newly laid Portland cement concrete pavements is illustrated by the accompanying sketch. In using this rod a thin metal plate is spotted on the subgrade paper, thus eliminating the possibility of the plate being moved when the concrete is placed on the subgrade. After the concrete has been placed and finished the rod is pushed through the pavement to the metal plate, the cap is placed on the rod and the rod is plumbed by obtaining a uniform bearing between the rim of the cap and the surface of the pavement. The thickness of the pavement is then obtained by reading the scale at the top of the collar on the cap. The hat-like shape of the cap eliminates somewhat the error that might be caused by the disturbed surface near the rod.

Cement Sampler: S. N. Thompson, Junior Engineer—The accompanying sketch illustrates a tube used for sampling bulk cement shipments. It is constructed from brass tubing $1\frac{1}{8}$ in. in diameter and 1/16 in. thick, and $5\frac{1}{2}$ ft. long, having a solid point of plumb-bob type. The vents $\frac{1}{2}$ in. wide and 4 in. long and at 4 in. intervals are made with one side slightly raised to act as cutting blades. It has been the inspectors' experience that the best results are obtained when the tube is inserted at an angle of about 45 deg. with the openings on the under side, then turning the tube one and one-half revolutions and withdrawing with the vents up. If the cement has been loaded for some time and is densely packed it is necessary to increase the revolutions of the tube. The inspector has used an inner tube of 1 in. diameter with the above sampling tube removing it before rotating the tube and found it quite satisfactory, but it is unnecessary when the tube is inserted with vents on under side.

Modulus Test Device: M. E. De Reus, Junior Engineer—The Missouri state highway department has recently undertaken an investigation to determine the influence of various factors upon the modulus of elasticity of concrete. One of the factors under consideration is the elastic property of the aggregate but, since it is difficult to obtain large representative specimens of a gravel aggregate, a method was devised which would accurately measure the deformation of individual specimens on a gage length as short as 1 in.

The method consists essentially of the microscopic measurement of the relative movement of a lever fastened to a cylindrical specimen, 1 in. in diameter.

The design of the lever is best described by the accompanying sketch. The upper arm is fixed to the specimen while the lower arm, which magnifies and transmits the average deformation of two opposite sides of the specimen to the brass plates at the end of the arms, is pivoted on the specimen. The ring serves as the fulcrum of the lever.

The relative displacement of the brass plates is measured by a microscope which is equipped with a vertical illumination, an 8-mm. objective and a filar micrometer eyepiece.

The total magnification of the apparatus is 1250 times the actual deformation of the specimen and one graduation on the drum of the filar micrometer eyepiece is equal to a deformation, on the gauge length of the specimen, of 0.000003 in. In making the measurements the cross hair of the eyepiece is easily set to plus or minus one-half drum gradation.

A briquette molding machine is utilized for applying the increments of stress to the specimen and since the loading is manual no vibration is produced to interfere with the microscopical method of determining the deformation.

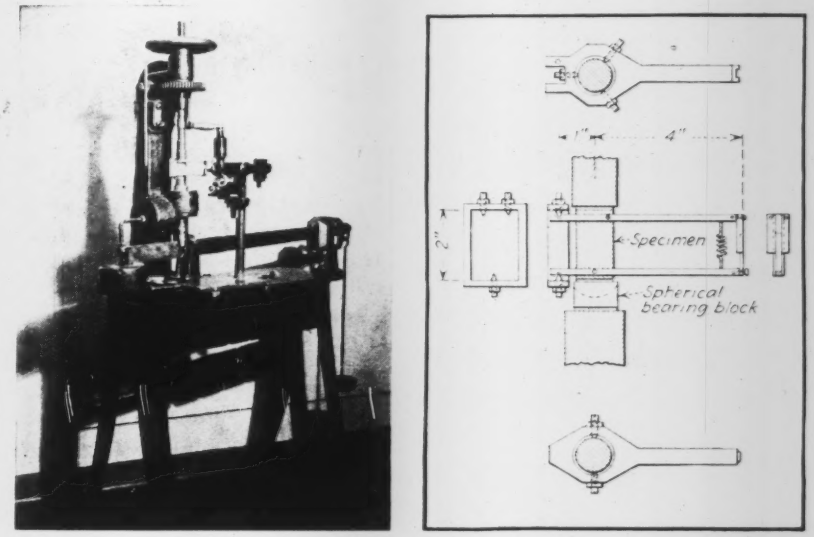

Fig. 3. Briquette machine and specimen holder for modulus tests of small aggregate specimens.

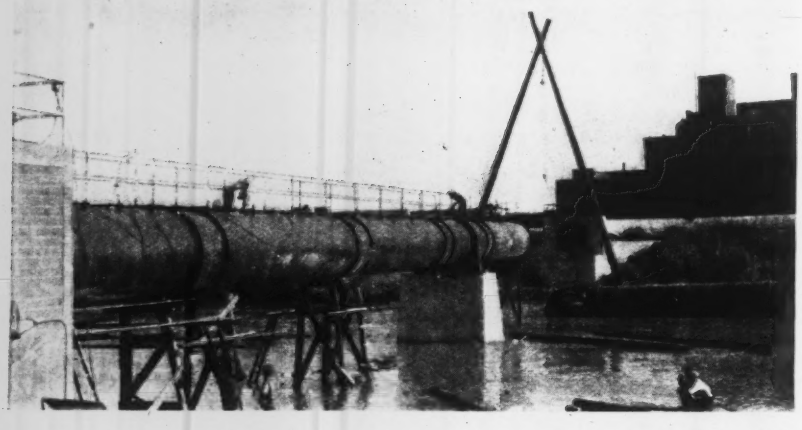

FIG. 1. HOISTING SECTIONS OF THE PIPE INTO PLACE WITH AN "A" FRAME

Longest Self-Supporting Pipe Built at Denver

by B. G. NORFOLK
Denver, Colo.

North Platte River crossed in two spans of 72-in. height, each 105 ft. long

NEW THEORIES of design of long-span thin-shell pipes developed have made possible more common usage of this type of structure than would have been attempted a decade ago. Most recent of this type of structure is the newly-completed self-supporting pipe across the Platte River, conveying sewage to the new sewage treatment plant of the City of Denver. The pipe is a continuous structure 210 ft. long supported at the middle by a pier, dividing its length into two equal spans of 105 ft. each—the longest in the world.

The pipe is fixed at the center and has expansion joints at each end incorporated in the concrete wall of the inlet and outlet structures. Rigid ring girder supports or stiffener rings support the pipe at the center and at each end of the span. These rings are welded continuously to the pipe shell and transmit the load from the pipe to the concrete structure by means of two vertical legs. Each leg of the center support ring is mounted directly upon a steel bearing plate secured to the leg by four 2½ in. diameter anchor bolts. At the abutments the vertical legs are mounted on grooved rollers provided with pins to resist any uplift loads. Normally these pins do no work, as all downward loads are carried by the rockers. The latter relieve the vertical legs of shearing and bending stress.

Riverbed clearance

The bottom of the pipe is 13 ft. above the river bed and will normally be about two-thirds full, carrying about 40,000,000 gal. of sewage a day. A board walk 30 in. wide with a two-line hand rail of 1½-in. pipe on both sides is mounted on top of the conveying pipe. Because of corrosive conditions, the pipe is made of corrosion-resisting metal, and is 78 in. inside diameter varying in thickness from $\frac{5}{8}$ in. at the ends to 1½ in. at the center. At each side of the field joints is a $\frac{3}{8}$- by 4-in. steel flange with the 4-in. side outstanding. These flanges are not necessary in the design but were used to hold the pipe in shape during hauling and erection.

The fundamental principle of design is prevention of distortion of the shell at the supports, and stiffener rings are used to hold the pipe to its circular shape. For design purposes, the weight of pipe and contents when full was computed to be 2,600 lb. per lineal ft., with an additional 400 lb. per lineal ft. for the walkway, and a vertical concentrated load of 2,000 lb. to be applied at any point, making a total combined vertical dead and live load of 5,000 lb. per lineal ft. A horizontal load of 400 lb. per lineal ft. was used. The designers also investigated the combined uplift of the horizontal loading for the condition of the pipe when empty and completely submerged.

Stresses in the pipe

The maximum negative bending moment occurs at the center pier and is computed to be 4,240,000 ft. lb.; the maximum positive bending moment is 2,350,000 ft. lb. and occurs at a distance of 39 ft. 4 in. from the abutment support rings. The points of contraflexure are 26 ft. 3 in. each side of center. The calculated maximum deflection in each span at the point of maximum positive bending moment is one inch. Maximum unit stress in the pipe shell is at the center support and is 10,500 lb. per sq.in., and the maximum stress in the pipe shell in the spans is 9,900 lb. per sq.in.

The rigid ring girder at the center is made of a 40-lb. 12-in. I beam. This ring is made by first splitting the I beam along its neutral axis, rolling the two resulting Tees to the required diameter, and then welding the two sections together. Suitable diaphragm stiffeners are welded to the web of the I beam ring at points subject to large shearing stresses. The leg supports are built up from one inch plates by welding them in the form of an H-section.

The structure is designed, manufactured, and erected by the Thompson Manufacturing Pipe Co. of Denver. The contract price for the pipe, walk, and railing is $17,500, and this type of construction is found to be 20 per cent more economical than a steel truss carrying a concrete or steel pipe, or a steel pipe supported on a number of piers. Less obstruction to the river flow is afforded by this type of structure.

THE WEEK'S EVENTS

Continued from page 527

Approach Contracts Let On Tunnel and Bridge

Contracts were awarded April 4 for construction of approaches to the Lincoln Tunnel and the George Washington Bridge by the Port of New York Authority. A $1,032,000 contract for construction of a section of the New Jersey approach to the tunnel was awarded to James Mitchell, Inc. of New York. It covers a three-level traffic interchange at the Hudson County boulevard intersection, two bridges across the main approach, and cut and fill sections of a ramp connecting state highway No. 1 with the Patterson Plank Road.

L. K. Comstock & Co. of New York City was awarded a $104,000 contract for installation of electrical equipment in the tunnel approach to the George Washington Bridge.

OBITUARY

TILLINGHAST L'H. HUSTON, engineer and contractor and formerly co-owner of the New York Yankees Baseball Club, died in Brunswick, Ga., March 29 at the age of 71. Huston received his first construction experience working with his father, a civil engineer and railroad builder, on the construction of sections of the Louisville & Nashville Railroad. He served as captain of engineers in Cuba during the Spanish American war and remained there after the war was over, obtaining a lucrative dredging contract for the improvement of Havana and other Cuban harbors. He served in France during the World War in the 16th Engineers and the First Army, rising to the rank of lieutenant-colonel.

WARREN VAN DYKE, secretary of highways in Pennsylvania since 1935, died in Baltimore March 30 at the age of 60. Van Dyke had been active in Pennsylvania politics for many years and earlier had been a newspaper man.

WILLIAM R. SCANLON, chief engineer of the Philadelphia Rapid Transit Co., died March 30 in Philadelphia at the age of 52. Scanlon joined the staff of the transit company in 1903 as a civil engineer and draftsman. He held that position until 1908, meanwhile studying evenings at Drexel Institute, and then transferred to the New York Shipbuilding Co., Camden, N. J., as a structural draftsman. A few months later he entered the chief engineer's office of the Philadelphia & Reading R.R. and in 1912 he returned to the transit company as a structural designer on subways and elevated railways. In 1915 he served briefly as architect and engineer on the construction of a warehouse in Philadelphia and then became assistant engineer for the Department of City Transit there, again on subway and elevated work. He transferred back to the transit company in 1918 and had remained with them since, first as structural engineer on rolling stock and buildings, then as assistant to the vice-president in charge of engineering, and since 1927 as chief engineer.

SAMUEL A. HART, 52, who was city engineer of Sacramento, Calif., in 1928, died recently. In recent years, Hart had been on the engineering staff of the state of California.

MARTIN L. DOWLING, formerly city engineer of Denver, Colo., died in Los Angeles March 20 at the age of 72.

JOHN HASSETT, an engineer in the Connecticut state highway department, was killed March 28 when a steel measuring tape he was using came in contact with a power line. Hassett was taking measurements on a Merritt Parkway bridge over railroad tracks in Norwalk.

EDWARD R. HOUGHTON, 61, contract engineer with the Union Pacific R.R. for the past 30 years, died in Omaha March 28.

VENNING D. SIMONS, consulting industrial engineer of Chicago and builder of paper mill plants in this country and Canada, died March 24 in Tucson, Ariz., at the age of 67. Simons had early experience with the Cornell Wood Products Co. and the Westinghouse Electric & Mfg. Co. He had maintained a consulting office since 1913.

HERBERT W. CROW, 48, assistant city engineer in charge of pavement of Binghamton, N. Y., died there April 4. Crow was a graduate of Clarkson School of Technology and had been with the city of Binghamton for ten years. Earlier he was with the engineering firm of Hoadley & Giles.

ARTHUR J. PATTERSON, construction and signal engineer for the engineering advisory committee on ways and structures of the Chesapeake & Ohio Ry., died recently in Lakewood, Ohio, at the age of 52. Patterson served as a captain of engineers during the World War.

THOMAS F. MCQUADE, for 11 years assistant engineer with the New York City Board of Transportation, died in New York April 5, aged 61. After some private experience, McQuade entered the city service in 1912 as engineer for the Board of Water Supply.

R. L. LOUCKS, former city engineer of Oceanside, Calif., died recently at Orange.

EDWARD H. JAMES, Montreal consulting engineer who specialized in dock and harbor work, died in Montreal at the age of 51 on April 1. James came to Canada from England in 1914 and worked with The Foundation Co. of Canada. After service during the war with the Canadian forces and in the English Royal Engineers, he joined A. D. Swan, Montreal consultant; he later entered into partnership with Swan and carried on the practice when Swan retired.

BRIEF NEWS

SURVEYS are being carried on in a number of Connecticut cities by the state department of health to eliminate contamination of water arising from faulty plumbing. All buildings more than three stories high, all stores above one story, and all hotels, theaters and factories are being examined.

APPROVAL of the Canadian government to construction of a new bridge over the Niagara Gorge to replace the recently destroyed Falls View Bridge is provided in a bill now being considered by the House of Commons. The bill would empower a company to construct a bridge, but each of the proposed directors has filed a surrender of his rights to the province of Ontario, thus making the company a dummy to permit erection of a public structure.

TWENTY-TWO sewage treatment plant operators from various parts of New York State completed a two-weeks course of special instruction at the new sanitary laboratory of New York University. The course was designed to assist the men in meeting operator qualification requirements established last October by the Public Health Council of the state. The course was conducted by Professor L. V. Carpenter and Dr. Lloyd Setter of the University faculty, and Charles C. Agar, senior sanitary engineer of the State Department of Health.

CALENDAR OF MEETINGS

NATIONAL SOCIETIES

AMERICAN SOCIETY OF CIVIL ENGINEERS. Spring meeting, Jacksonville, Fla., April 20-23.

AMERICAN SHORE & BEACH PRESERVATION ASSOCIATION annual meeting, Washington, D. C., April 19, and Jacksonville, Fla., April 21.

AMERICAN WATER WORKS ASSOCIATION, annual convention, Roosevelt Hotel, New Orleans, April 24-28.

WATER WORKS MANUFACTURERS ASSOCIATION, annual meeting, Roosevelt Hotel, New Orleans, April 27.

CONCRETE REINFORCING STEEL INSTITUTE, annual meeting, The Homestead, Hot Springs, Va., April 28-29.

NATIONAL LIME ASSOCIATION, annual convention, Netherland-Plaza Hotel, Cincinnati, May 9-10

REGIONAL AND LOCAL

GREATER NEW YORK SAFETY COUNCIL, annual convention, Hotel Astor, New York City, April 19-21.

AMERICAN WELDING SOCIETY, Pittsburgh section, and ENGINEERS SOCIETY OF WESTERN PENNSYLVANIA, tri-state welding conference, William Penn Hotel, Pittsburgh, April 29.

AMERICAN SOCIETY OF CIVIL ENGINEERS, Texas Section, spring meeting, Texas State Hotel, Houston, April 29-30.

MARYLAND-DELAWARE WATER AND SEWERAGE ASSOCIATION, annual conference, Emerson Hotel, Baltimore, May 19-20.

SECTION MEETINGS, American Water Works Association:
Pacific Northwest, Spokane, May 19-21.

ELECTIONS AND ACTIVITIES

GEORGE M. SHEPARD is the new president of the Minnesota Federation of Architectural and Engineering Societies. Other new officers are as follows: H. E. McWethy, William E. Hawley, George C. Darrell, vice-presidents; J. R. Johnston, treasurer.

OFFICERS for 1938 of the Minnesota Surveyors and Engineers Society are I. E. Odendahl, president; A. F. Stegner, vice-president; and J. C. Robbers, secretary-treasurer.

THE BUILDING OFFICIALS CONFERENCE OF AMERICA, at its annual convention in Washington, elected Louis C. Clousing, Minneapolis, president, and John W. Oehmann, Washington, first vice-president. Walker S. Lee, Rochester, N. Y., is the new second vice-president of the organization.

EDWIN A. FAIRBAIRN is the newly elected president of the County Engineers Association of California. Other officers elected at the convention last month are Owen O'Neil, vice-president; and Lloyd Bowman, secretary-treasurer.

THE CORPORATION OF PROFESSIONAL ENGINEERS OF QUEBEC at its annual meeting last month re-elected A. R. Decary as president. James A. Kearns was elected secretary-treasurer.

E. PRAEGER has been elected president of the New York City Chapter of the New York State Society of Professional Engineers.

MATTHEW HILLER was elected president of the Structural Engineers Society at its annual meeting in New York City. Other officers are W. W. Chapin, vice-president; A. L. Stevenson, secretary; and Ralph Squire, treasurer.

FLETCHER THOMPSON was elected president of the Arkansas Water and Sewage Conference at its session last month. H. S. Peck is vice chairman, and Harrison Hale is secretary-treasurer.

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Short Courses

TRAFFIC ENGINEERING seminar at Pennsylvania State College, State College, Pa.; sponsored by American Public Works Association, Institute of Local Government of the College, and the Institute of Traffic Engineers; April 27-29.

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Dredging Starts Early At Fort Peck

The final season of dredging operations at Fort Peck Dam on the Missouri River in Montana, where 100,000,000 cu. yd. of fill is being placed by the hydraulic method, got off to an early start Mar. 3 when two dredges started pumping into the upstream toe berm. Filling of the main embankment was resumed Mar. 28 by the two remaining 28-in. dredges of the four-dredge hydraulic plant.

At the end of last season 82,000,000 yd. had been placed in the fill, leaving but 28,000,000 to be placed this year. Last season, despite the delays occasioned by diverting the river through the four tunnels and moving the dredging plant from upstream to downstream borrowpits, more than 32,000,000 cu. yd. was placed. Dredging this year started 33 days ahead of any prior season.

Work at the government quarry at Snake Butte has been resumed.

PERSONAL

R. M. GILLIS has been promoted to the position of chief construction engineer of the California state division of highways, succeeding the late C. S. Pope. Gillis has been district engineer at Fresno for the past five years. Before his connection with the California division of highways, he was associated with the Washington state highway department.

EARL T. SCOTT, maintenance engineer in the Los Angeles office of the California division of highways, has been made division engineer at Fresno, succeeding R. M. Gillis.

JESSE E. BUCHANAN has been named dean of the school of engineering at the University of Idaho, effective July 1.

ODD ALBERT, general manager of the Opla Co. of East Orange, N. J., has been appointed assistant professor of structural engineering at Newark School of Engineering, and editor of the Newark Engineering Notes to be published by the college.

HENRY MILLER, for 18 years president of the Terminal Railroad Association of St. Louis, has retired.

G. M. MAGEE, formerly assistant engineer for the Kansas City Southern Ry. at Kansas City, has been appointed research engineer in the engineering division of the Association of American Railroads, with office at Chicago.

WILLIAM GERIG, head engineer in the office of the Chief of Engineers, at Washington, retired April 1 at the age of 72, after his retirement had twice been postponed by Presidential edict. Gerig is a graduate in 1886 of Missouri State University. After working with a number of Western railroads, he first became connected with the U. S. Engineers as an instrumentman for the Missouri River Commission, a few months later becoming assistant engineer for the Mississippi River Commission. From 1905 to 1908, he was division engineer on the Panama Canal, leaving that position to become chief engineer of the Pacific & East R. R. He left that post in 1915 and held positions with various railroads until in 1923 he joined the office of the Chief of Engineers.

JAKE HOEKSEMA has been appointed engineer of Lucas County, Iowa.

A. R. BARTELL, formerly engineer of Lucas County, has been appointed engineer of Cedar County, Iowa.